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KEY

KEY

TO

SCHOOL CLASS BOOK OF ARITHMETIC.

PART II.

Cambridge:
PRINTED BY C. J. CLAY, M.A.
AT THE UNIVERSITY PRESS.

KEY

TO

SCHOOL CLASS BOOK

OF

ARITHMETIC.

PART II.

BY

BARNARD SMITH, M.A.

RECTOR OF GLASTON, RUTLAND, LATE FELLOW AND SENIOR
BURSAR OF ST PETER'S COLLEGE, CAMBRIDGE.

Cambridge and London:
MACMILLAN AND CO.
1865.

1802 f 97

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SOLUTIONS, &c.

PART II.

GREATEST COMMON MEASURE.

Ex. I. Page 4.

1. (1) 15) 24 (1
15
9) 15 (1
9
6) 9 (1
6
3) 6 (2
6
∴ 3 is G. C. M.

(2) 20) 36 (1
20
16) 20 (1
16
4) 16 (4
16
∴ 4 is G. C. M.

(3) 35) 75 (2
70
5) 35 (7
35
∴ 5 is G. C. M.

(4) 30) 44 (1
30
14) 30 (2
28
2) 14 (7
14
∴ 2 is G. C. M.

(5) 42) 81 (1
42
39) 42 (1
39
3) 39 (13
39
∴ 3 is G. C. M.

(6) 63) 147 (2
126
21) 63 (3
63
∴ 21 is G. C. M.

(7) 90) 105 (1
90
15) 90 (6
90

∴ 15 is G. C. M.

(8) 325) 403 (1
325
78) 325 (4
312
13) 78 (6
78

∴ 13 is G. C. M.

(9) 348) 1024 (2
696
328) 348 (1
328
20) 328 (16
20
128
120
8) 20 (2
16
4) 8 (2
8

∴ 4 is G. C. M.

(10) 132) 189 (1
132
57) 132 (2
114
18) 57 (3
54
3) 18 (6
18

∴ 3 is G. C. M.

(11) 532) 1274 (2
1064
210) 532 (2
420
112) 210 (1
112
98) 112 (1
98
14) 98 (7
98

∴ 14 is G. C. M.

(12) 235) 371 (1
235
136) 235 (1
136
99) 136 (1
99
37) 99 (2
74
25) 37 (1
25
12) 25 (2
24
1) 12 (12
12

∴ 1 is G. C. M.

(13) 576) 1088 (1
576
512) 576 (1
512
64) 512 (8
512

∴ 64 is G. C. M.

(14) 1905) 3175 (1
1905
1270) 1905 (1
1270
635) 1270 (2
1270

∴ 635 is G. C. M.

(15) 858) 996 (1
858
138) 858 (6
828
30) 138 (4
120
18) 30 (1
18
12) 18 (1
12
6) 12 (2
12

∴ 6 is G. C. M.

(16) 2209) 7921 (3
6627
1294) 2209 (1
1294
915) 1294 (1
915
379) 915 (2
758
157) 379 (2
314
65) 157 (2
130
27) 65 (2
54
11) 27 (2
22
5) 11 (2
10
1) 5 (1
5

∴ 1 is G. C. M.

(17) 2145) 3471 (1
2145
1326) 2145 (1
1326
819) 1326 (1
819
507) 819 (1
507
312) 507 (1
312
195) 312 (1
195
117) 195 (1
117
78) 117 (1
78
39) 78 (2
78

∴ 39 is G. C. M.

(18) 6509) 7889 (1
6509
1380) 6509 (4
5520
989) 1380 (1
989
391) 989 (2
782
207) 391 (1
207
184) 207 (1
184
23) 184 (8
184

∴ 23 is G. C. M.

(19) 5252) 8484 (1
5252
3232) 5252 (1
3232
2020) 3232 (1
2020
1212) 2020 (1
1212
808) 1212 (1
808
404) 808 (2
808

∴ 404 is G. C. M.

(20) 8280) 11385 (1
8280
3105) 8280 (2
6210
2070) 3105 (1
2070
1035) 2070 (2
2070

∴ 1035 is G. C. M.

(21)

```
429 ) 15717 ( 36
      1287
      ----
       2847
       2574
       ----
        273 ) 429 ( 1
              273
              ---
              156 ) 273 ( 1
                    156
                    ---
                    117 ) 15  ( 1
                          117
                          ---
                           39 ) 117 ( 3
                                117
                                ---
```

∴ 39 is G. C. M.

(22)

```
13536 ) 23148 ( 1
        13536
        -----
         9612 ) 13536 ( 1
                 9612
                 ----
                 3924 ) 9612 ( 2
                        7848
                        ----
                        1764 ) 3924 ( 2
                               3528
                               ----
                                396 ) 1764 ( 4
                                      1584
                                      ----
                                       180 ) 396 ( 2
                                             360
                                             ---
                                              36 ) 180 ( 5
                                                   180
                                                   ---
```

∴ 36 is G.C.M.

(23)

```
15032 ) 19400 ( 1
        15032
        -----
         4368 ) 15032 ( 3
                13104
                -----
                 1928 ) 4368 ( 2
                        3856
                        ----
                         512 ) 1928 ( 3
                               1536
                               ----
                                392 ) 512 ( 1
                                      392
                                      ---
                                      120 ) 392 ( 3
                                            360
                                            ---
                                             32 ) 120 ( 3
                                                   96
                                                  ---
                                                   24 ) 32 ( 1
                                                        24
                                                        --
                                                         8 ) 24 ( 3
                                                             24
                                                             --
```

∴ 8 is G. C. M.

(24) 143168) 2064888 (14
143168
633208
572672
60536) 143168 (2
121072
22096) 60536 (2
44192
16344) 22096 (1
16344
5752) 16344 (2
11504
4840

4840) 5752 (1
4840
912) 4840 (5
4560
280) 912 (3
840
72) 280 (3
216
64) 72 (1
64
8) 64 (8
64

∴ 8 is G. C. M.

2. (1) 8) 10 (1
8
2) 8 (4
8

∴ 2 is G. C. M.

2) 12 (6
12

∴ 2 is G. C. M. required.

(2) 12) 16 (1
12
4) 12 (3
12

∴ 4 is G. C. M.

4) 24 (6
24

∴ 4 is G. C. M. required.

(3) 8) 28 (3
24
4) 8 (2
8

∴ 4 is G. C. M.

4) 38 (9
36
2) 4 (2
4

∴ 2 is G. C. M. required.

(4) 35) 50 (1
35
15) 35 (2
30
5) 15 (3
15

∴ 5 is G. C. M.

5) 75 (15
75

∴ 5 is G. C. M.

5) 80 (16
80

∴ 5 is G. C. M. required.

(5) 18) 24 (1
18
6) 18 (3
18

∴ 6 is G. C. M.

6) 27 (4
24
3) 6 (2
6

∴ 3 is G. C. M.

3) 30 (10
30

∴ 3 is G. C. M. required.

(6) 129) 420 (3
387
33) 129 (3
99
30) 33 (1
30
3) 30 (10
30

∴ 3 is G. C. M.

3 | 903
301

∴ 3 is G. C. M. required.

(7) 492) 1044 (2
984
60) 492 (8
480
12) 60 (5
60

∴ 12 is G. C. M.

12) 744 (62
72
24
24

∴ 12 is G. C. M. required.

```
(8)  333) 414 (1
          333
          ---
          81) 333 (4
              324
              ---
                9) 81 (9
                   81
                   --
```

∴ 9 is G. C. M.

```
9) 714 (79
   63
   --
    84
    81
    --
     3) 9 (3
        9
        -
```

∴ 3 is G. C. M. required.

```
(9)  504) 5292 (10
          504
          ----
           252) 504 (2
                504
                ---
```

∴ 252 is G. C. M.

```
252) 1520 (6
     1512
     ----
        8) 252 (31
           24
           --
            12
             8
            --
             4) 8 (2
                8
                -
```

∴ 4 is G. C. M. required.

```
(10)  9768) 12408 (1
             9768
             ----
             2640) 9768 (3
                   7920
                   ----
                   1848) 2640 (1
                         1848
                         ----
                          792) 1848 (2
                               1584
                               ----
                                264) 792 (3
                                     792
                                     ---
```

∴ 264 is G. C. M.

```
264) 11616 (44
     1056
     ----
      1056
      1056
      ----
```

∴ 264 is G.C.M. required.

3. 1 lb. Avoird. = 7000 grs. Troy.; 1 lb. Troy = 5760 grs. Troy.

5760) 7000 (1
5760
1240) 5760 (4
4960
800) 1240 (1
800
440) 800 (1
440
360) 440 (1
360
80) 360 (4
320
40) 80 (2
80

Ans. 40 grs.

4. £26. 15*s*. 6*d*. = 6426*d*.; £40. 8*s*. 6*d*. = 9702*d*.

6426) 9702 (1
6426
3276) 6426 (1
3276
3150) 3276 (1
3150
126) 3150 (25
252
630
630

G.C.M. is 126.
Now 126*d*. ÷ 12 = 10*s*. 6*d*.
∴ Ans. = Half-guineas.

5. 360) 400 (1
360
40) 360 (9
360

∴ 40 is G.C.M.

∴ 40, 20, 10, 8, 5, 4, 2, are common measures

LEAST COMMON MULTIPLE.

Ex. II. Page 8.

1. (1) 10) 15 (1
10
5) 10 (2
10

∴ 5 is G.C.M. of 10 and 15;

∴ L.C.M. $=\frac{10\times15}{5}=\frac{150}{5}=30$.

(2) 15) 18 (1
15
3) 15 (5
15

∴ 3 is G.C.M. of 15 and 18;

∴ L.C.M. $=\frac{15\times18}{3}=\frac{270}{3}=90$.

(3) 20) 24 (1
20
4) 20 (5
20

∴ 4 is G.C.M. of 20 and 24;

∴ L.C.M. $=\frac{20\times24}{4}=\frac{480}{4}=120$.

(4) 25) 35 (1
25
10) 25 (2
20
5) 10 (2
10

∴ 5 is G.C.M. of 25 and 35;

∴ L.C.M. $=\frac{25\times35}{5}=\frac{875}{5}=175$.

(5) 42) 72 (1
42
30) 42 (1
30
12) 30 (2
24
6) 12 (2
12

∴ 6 is G. C. M. of 42 and 72;

∴ L. C. M. $=\frac{42\times72}{6}=\frac{3024}{6}=504$.

(6) 5) 18 (3
15
3) 5 (1
3
2) 3 (1
2
1

∴ L. C. M. $= 5 \times 18 = 90$.

(7) 51) 85 (1
51
34) 51 (1
34
17) 34 (2
34

∴ 17 is G. C. M. of 51 and 85;

$$\therefore \text{ L. C. M.} = \frac{51 \times 85}{17} = \frac{4335}{17} = 255.$$

(8) 75) 120 (1
75
45) 75 (1
45
30) 45 (1
30
15) 30 (2
30

∴ 15 is G. C. M. of 75 and 120;

$$\therefore \text{ L. C. M.} = \frac{75 \times 120}{15} = \frac{9000}{15} = 600.$$

(9) 96) 256 (2
192
64) 96 (1
64
32) 64 (2
64

∴ 32 is G. C. M. of 96 and 256;

$$\therefore \text{ L. C. M.} = \frac{96 \times 256}{32} = \frac{24576}{32} = 768.$$

(10) 224) 336 (1
224
112) 224 (2
224

∴ 112 is G. C. M. of 224 and 336;

$$\therefore \text{ L. C. M.} = \frac{224 \times 336}{112} = \frac{75264}{112} = 672.$$

(11) 888) 2775 (3
2664
111) 888 (8
888

$\therefore$ 111 is G. C. M. of 888 and 2775;

$\therefore$ L. C. M. $\dfrac{888 \times 2775}{111} = \dfrac{2464200}{111} = 22200.$

(12) 7056) 7392 (1
7056
336) 7056 (21
672
336
336

$\therefore$ 336 is G. C. M. of 7056 and 7392;

$\therefore$ L. C. M. $= \dfrac{7056 \times 7392}{336} = \dfrac{52157952}{336} = 155232.$

(13)
2145) 3471 (1
2145
1326) 2145 (1
1326
819) 1326 (1
819
507) 819 (1
507
312) 507 (1
312
195) 312 (1
195
117) 195 (1
117
78) 117 (1
78
39) 78 (2
78

$\therefore$ 39 is G. C. M. of 2145 and 3471;

$\therefore$ L. C. M. $= \dfrac{2145 \times 3471}{39} = \dfrac{7445295}{39} = 190905.$

(14) 3575) 125455 (35
10725
18205
17875
330) 3575 (10
330
275) 330 (1
275
55) 275 (5
275

∴ 55 is the G. C. M. of 3575 and 125455;

$$\therefore \text{L. C. M.} = \frac{3575 \times 125455}{55} = \frac{448501625}{55} = 8154575.$$

(15) 13536) 23148 (1
13536
9612) 13536 (1
9612
3924) 9612 (2
7848
1764) 3924 (2
3528
396) 1764 (4
1584
180) 396 (2
360
36) 180 (5
180

∴ 36 is G. C. M. of 13536 and 23148;

$$\therefore \text{L. C. M.} = \frac{13536 \times 23148}{36} = \frac{313331328}{36} = 8703648.$$

2. (1) $3\ \underline{\big|\ \cancel{4},\ 9,\ 12}$
$\qquad 3,\ \ 4$ $\qquad\therefore$ L. C. M. $= 3 \times 3 \times 4 = 36.$

(2) $3\ \underline{\big|\ \cancel{6},\ 18,\ 15}$
$\qquad 6,\ \ 5$ $\qquad\therefore$ L. C. M. $= 3 \times 6 \times 5 = 90.$

(3)
$$\begin{array}{r|rrr} 4 & 8, & 20, & 28 \\ \cline{2-4} & 2, & 5, & 7 \end{array}$$
$\therefore$ L. C. M. $= 4 \times 2 \times 5 \times 7$
$= 280.$

(4)
$$\begin{array}{r|rrr} 4 & 15, & 20, & 24 \\ \cline{2-4} 3 & 15, & \cancel{5}, & 6 \\ \cline{2-4} & 5, & & 2 \end{array}$$
$\therefore$ L. C. M. $= 4 \times 3 \times 5 \times 2 = 120.$

(5)
$$\begin{array}{r|rrr} 5 & 25, & 60, & 45 \\ \cline{2-4} 3 & 5, & 12, & 9 \\ \cline{2-4} & 5, & 4, & 3 \end{array}$$
$\therefore$ L.C.M. $= 5 \times 3 \times 5 \times 4 \times 3 = 900.$

(6)
$$\begin{array}{r|rrr} 3 & 21, & 33, & 56 \\ \cline{2-4} 7 & 7, & 11, & 56 \\ \cline{2-4} & 1, & 11, & 8 \end{array}$$
$\therefore$ L. C. M. $= 3 \times 7 \times 11 \times 8 = 1848.$

(7)
$$\begin{array}{r|rrrr} 7 & 63, & \cancel{12}, & 84, & 72 \\ \cline{2-5} & \cancel{9}, & & \cancel{12}, & 72 \\ \cline{2-5} \end{array}$$
$\therefore$ L. C. M. $= 7 \times 72 = 504.$

(8)
$$\begin{array}{r|rrrr} 2 & \cancel{16}, & \cancel{32}, & 26, & 96 \\ \cline{2-5} & & & 13, & 48 \end{array}$$
$\therefore$ L. C. M. $= 2 \times 13 \times 48 = 1248.$

(9)
$$\begin{array}{r|rrrrrrr} 2 & 4, & \cancel{9}, & 10, & 14, & 15, & 18, & 21 \\ \cline{2-8} 3 & 2, & & \cancel{5}, & \cancel{7}, & 15, & 9, & 21 \\ \cline{2-8} & 2, & & & & 5, & 3, & 7 \end{array}$$
$\therefore$ L. C. M. $= 2 \times 3 \times 2 \times 5 \times 3 \times 7 = 1260.$

(10)
$$\begin{array}{r|rrrrrr} 2 & \cancel{14}, & 18, & 24, & 35, & 42, & 68 \\ \cline{2-7} 3 & & 9, & 12, & 35, & 21, & 34 \\ \cline{2-7} 2 & & 3, & 4, & 35, & \cancel{7}, & 34 \\ \cline{2-7} & & 3, & 2, & 35, & & 17 \end{array}$$
$\therefore$ L. C. M. $= 2 \times 3 \times 2 \times 3 \times 2 \times 35 \times 17 = 42840.$

(11)
$$\begin{array}{r|rrrrrrrr} 2 & \cancel{8}, & \cancel{12}, & \cancel{16}, & \cancel{24}, & \cancel{36}, & 54, & \cancel{72}, & 144 \\ \cline{2-9} 9 & & & & & & 27, & & 72 \\ \cline{2-9} & & & & & & 3, & & 8 \end{array}$$
$\therefore$ L. C. M. $= 2 \times 9 \times 3 \times 8 = 432.$

(12)
$$\begin{array}{r|cccccccccc}
2 & 24, & 16, & \cancel{6}, & 20, & \cancel{8}, & \cancel{10}, & 30, & \cancel{4}, & 25, & \cancel{12} \\ \hline
2 & 12, & 8, & & 10, & & & 15, & & 25, & \\ \hline
2 & 6, & 4, & & \cancel{5}, & & & 15, & & 25, & \\ \hline
5 & \cancel{3}, & 2, & & & & & 15, & & 25, & \\ \hline
 & & 2, & & & & & 3, & & 5, &
\end{array}$$

$\therefore$ L. C. M. $=2\times2\times2\times5\times2\times3\times5=1200$.

(13)
$$\begin{array}{r|cccc}
4 & 760, & 364, & 336, & 1736 \\ \hline
7 & 190, & 91, & 84, & 434 \\ \hline
2 & 190, & 13, & 12, & 62 \\ \hline
 & 95, & 13, & 6, & 31
\end{array}$$

$\therefore$ L. C. M. $=4\times7\times2\times95\times13\times6\times31=12863760$.

(14)
$$\begin{array}{r|ccccc}
10 & \cancel{10}, & \cancel{200}, & 550, & 70400, & 1000000 \\ \hline
5 & & & 55, & 7040, & 100000 \\ \hline
8 & & & \cancel{11}, & 1408, & 20000 \\ \hline
4 & & & & 176, & 2500 \\ \hline
 & & & & 44, & 625
\end{array}$$

$\therefore$ L. C. M. $=10\times5\times8\times4\times44\times625$
$=44000000$.

3. G. C. M. of 8 and 10 is 2 ;

$\therefore$ L. C. M. of 8 and 10 $=\frac{8\times10}{2}=\frac{80}{2}=40$.

G. C. M. of 40 and 12 is 4 ;

$\therefore$ L. C. M. of 40 and 12 $=\frac{40\times12}{4}=\frac{480}{4}=120$.

$\therefore$ in 120 minutes from starting the boys will again meet.

1st boy will have walked round the field $\frac{120}{8}$ or 15 times,

2nd... $\frac{120}{10}$ or 12 ....

3rd... $\frac{120}{12}$ or 10 ....

4. 1 gallon = 8 pints, 1 barrel = 36 × 8 or 288 pints, 1 hogshead = 54 × 8 or 432 pints,

∴ find the L. C. M. of 1, 8, 36 and 432.

$$\begin{array}{r|rrrr} 8 & 1, & \cancel{8}, & 288, & 432 \\ \hline 9 & & & 36, & 54 \\ \hline 2 & & & 4, & 6 \\ \hline & & & 2, & 3 \end{array}$$

∴ L. C. M. $= 8 \times 9 \times 2 \times 2 \times 3 = 864$;

∴ smallest cask required = 864 pints or 108 gallons.

5. Forewheel = 78 in.; hind wheel = 136 in.

G. C. M. of 78 and 136 is 2;

∴ L. C. M. of 78 and 136 $= \dfrac{78 \times 136}{2} = \dfrac{10608}{2} = 5304$;

∴ distance = 5304 in. = 442 ft.

In 10 miles this will happen $10 \times 1760 \times 3$, or $52800 \div 442$ times, or 119 times, rem. 202;

∴ *Ans.* = 119.

6.

$$\begin{array}{r|rrrrr} 2 & 8, & \cancel{9}, & 15, & 18, & 25 \\ \hline 5 & 4, & & 15, & 9, & 25 \\ \hline & 4, & & \cancel{3}, & 9, & 5 \end{array}$$

∴ L. C. M. $= 2 \times 5 \times 4 \times 9 \times 5 = 1800$.

Since the population is between 3000 and 4000 it must be $1300 \times 2 + 7 = 3600 + 7 = 3607$.

VULGAR FRACTIONS. Ex. III. Page 12.

1. $\dfrac{3}{13} \times 3 = \dfrac{9}{13}$; $\dfrac{3}{13} \times 4 = \dfrac{12}{13}$; $\dfrac{3}{13} \times 7 = \dfrac{21}{13}$; $\dfrac{3}{13} \times 8 = \dfrac{24}{13}$; $\dfrac{3}{13} \times 22 = \dfrac{66}{13}$.

2. $\dfrac{32}{45} \times 5 = \dfrac{160}{45}$; $\dfrac{32}{45} \times 9 = \dfrac{288}{45}$; $\dfrac{32}{45} \times 13 = \dfrac{416}{45}$; $\dfrac{32}{45} \times 26 = \dfrac{832}{45}$; $\dfrac{32}{45} \times 64 = \dfrac{2048}{45}$.

Ex. IV. Page 12.

1. $\frac{5}{7} \div 3 = \frac{5}{7 \times 3} = \frac{5}{21}$; $\frac{5}{7} \div 4 = \frac{5}{7 \times 4} = \frac{5}{28}$;

$\frac{5}{7} \div 7 = \frac{5}{7 \times 7} = \frac{5}{49}$; $\frac{5}{7} \div 15 = \frac{5}{7 \times 15} = \frac{5}{105}$;

$\frac{5}{7} \div 26 = \frac{5}{7 \times 26} = \frac{5}{182}$.

2. $\frac{13}{24} \div 2 = \frac{13}{24 \times 2} = \frac{13}{48}$; $\frac{13}{24} \div 11 = \frac{13}{24 \times 11} = \frac{13}{264}$;

$\frac{13}{24} \div 18 = \frac{13}{24 \times 18} = \frac{13}{432}$; $\frac{13}{24} \div 29 = \frac{13}{24 \times 29} = \frac{13}{696}$;

$\frac{13}{24} \div 56 = \frac{13}{24 \times 56} = \frac{13}{1344}$.

Ex. V. Page 13.

1.

$$6 = \frac{6}{1} = \frac{6 \times 2}{1 \times 2} = \frac{12}{2},$$

$$6 = \frac{6}{1} = \frac{6 \times 7}{1 \times 7} = \frac{42}{7},$$

$$6 = \frac{6}{1} = \frac{6 \times 13}{1 \times 13} = \frac{78}{13},$$

$$6 = \frac{6}{1} = \frac{6 \times 26}{1 \times 26} = \frac{156}{26},$$

$$11 = \frac{11}{1} = \frac{11 \times 2}{1 \times 2} = \frac{22}{2},$$

$$11 = \frac{11}{1} = \frac{11 \times 7}{1 \times 7} = \frac{77}{7},$$

$$11 = \frac{11}{1} = \frac{11 \times 13}{1 \times 13} = \frac{143}{13},$$

$$11 = \frac{11}{1} = \frac{11 \times 26}{1 \times 26} = \frac{286}{26},$$

$$15=\frac{15}{1}=\frac{15\times2}{1\times2}=\frac{30}{2},$$

$$15=\frac{15}{1}=\frac{15\times7}{1\times7}=\frac{105}{7},$$

$$15=\frac{15}{1}=\frac{15\times13}{1\times13}=\frac{195}{13},$$

$$15=\frac{15}{1}=\frac{15\times26}{1\times26}=\frac{390}{26}.$$

2.

$$19=\frac{19}{1}=\frac{19\times13}{1\times13}=\frac{247}{13},$$

$$19=\frac{19}{1}=\frac{19\times53}{1\times53}=\frac{1007}{53},$$

$$19=\frac{19}{1}=\frac{19\times116}{1\times116}=\frac{2204}{116},$$

$$19=\frac{19}{1}=\frac{19\times257}{1\times257}=\frac{4883}{257},$$

$$24=\frac{24}{1}=\frac{24\times13}{1\times13}=\frac{312}{13},$$

$$24=\frac{24}{1}=\frac{24\times53}{1\times53}=\frac{1272}{53},$$

$$24=\frac{24}{1}=\frac{24\times116}{1\times116}=\frac{2784}{116},$$

$$24=\frac{24}{1}=\frac{24\times257}{1\times257}=\frac{6168}{257},$$

$$85=\frac{85}{1}=\frac{85\times13}{1\times13}=\frac{1105}{13},$$

$$85=\frac{85}{1}=\frac{85\times53}{1\times53}=\frac{4505}{53},$$

$$85=\frac{85}{1}=\frac{85\times116}{1\times116}=\frac{9860}{116},$$

$$85=\frac{85}{1}=\frac{85\times257}{1\times257}=\frac{21845}{257}.$$

Ex. VI. Page 15.

1. $\frac{8}{2}=4$. 2. $\frac{19}{3}=6\frac{1}{3}$. 3. $\frac{27}{5}=5\frac{2}{5}$. 4. $\frac{17}{12}=1\frac{5}{12}$.

5. $\frac{34}{5}=6\frac{4}{5}$. 6. $\frac{32}{11}=2\frac{10}{11}$. 7. $\frac{59}{21}=2\frac{17}{21}$.

8. $\frac{245}{9}=27\frac{2}{9}$. 9. $\frac{3216}{19}=169\frac{5}{19}$. 10. $\frac{276}{23}=12$.

11. $\frac{9672}{81}=119\frac{33}{81}$. 12. $\frac{1346}{289}=4\frac{190}{289}$. 13. $\frac{966}{858}=1\frac{108}{858}$.

14. $\frac{10000}{111}=90\frac{10}{111}$. 15. $\frac{35706}{384}=92\frac{378}{384}$.

16. $\frac{86400}{907}=95\frac{235}{907}$. 17. $\frac{107533}{26411}=4\frac{1889}{26411}$.

18. $\frac{5555555}{90009}=61\frac{65006}{90009}$. 19. $\frac{8450033}{200000}=42\frac{50033}{200000}$.

20. $\frac{51800000}{37000}=1400$.

Ex. VII. Page 16.

1. $1\frac{4}{5}=\frac{1\times5+4}{5}=\frac{9}{5}$. 2. $2\frac{3}{7}=\frac{2\times7+3}{7}=\frac{17}{7}$.

3. $3\frac{4}{9}=\frac{3\times9+4}{9}=\frac{31}{9}$. 4. $7\frac{5}{6}=\frac{7\times6+5}{6}=\frac{47}{6}$.

5. $18\frac{5}{8}=\frac{18\times8+5}{8}=\frac{149}{8}$. 6. $23\frac{7}{11}=\frac{23\times11+7}{11}=\frac{260}{11}$.

7. $14\frac{12}{13}=\frac{14\times13+12}{13}=\frac{194}{13}$.

8. $56\frac{3}{19}=\frac{56\times19+3}{19}=\frac{1067}{19}$.

9. $153\frac{5}{14}=\frac{153\times14+5}{14}=\frac{2147}{14}$.

10. $74\frac{54}{99}=\frac{74\times 99+54}{99}=\frac{7380}{99}$.

11. $415\frac{1}{100}=\frac{415\times 100+1}{100}=\frac{41501}{100}$.

12. $15\frac{3}{2000}=\frac{15\times 2000+3}{2000}=\frac{30003}{2000}$.

13. $786\frac{29}{111}=\frac{786\times 111+29}{111}=\frac{87275}{111}$.

14. $3\frac{7568}{9504}=\frac{3\times 9504+7568}{9504}=\frac{36080}{9504}$.

15. $200\frac{5170}{8753}=\frac{200\times 8753+5170}{8753}=\frac{1755770}{8753}$.

16. $500005\frac{1}{500005}=\frac{500005\times 500005+1}{500005}=\frac{250005000026}{500005}$.

EX. VIII. Page 17.

1. $\frac{1}{3}$ of $\frac{6}{8}=\frac{1\times 6}{3\times 8}=\frac{1\times \cancel{2}\times \cancel{3}}{\cancel{3}\times \cancel{2}\times 4}=\frac{1}{4}$.

2. $\frac{2}{3}$ of $\frac{3}{4}=\frac{2\times \cancel{3}}{\cancel{3}\times 4}=\frac{2}{4}=\frac{\cancel{2}}{\cancel{2}\times 2}=\frac{1}{2}$.

3. $\frac{2}{7}$ of $\frac{5}{8}=\frac{2\times 5}{7\times 8}=\frac{\cancel{2}\times 5}{7\times \cancel{2}\times 4}=\frac{5}{7\times 4}=\frac{5}{28}$.

4. $\frac{3}{4}$ of $\frac{7}{8}=\frac{3\times 7}{4\times 8}=\frac{21}{32}$.

5. $\frac{2}{3}$ of $\frac{3}{4}$ of $2=\frac{2\times \cancel{3}\times 2}{\cancel{3}\times 4}=\frac{\cancel{2}\times \cancel{2}}{\cancel{2}\times \cancel{2}}=1$.

6. $\frac{2}{5}$ of $\frac{9}{10}$ of $25=\frac{2\times 9\times 25}{5\times 10}=\frac{\cancel{2}\times 9\times \cancel{5}\times \cancel{5}}{\cancel{5}\times \cancel{2}\times \cancel{5}}=\frac{9}{1}=9$.

7. $\frac{2}{3}$ of $\frac{11}{12}$ of $\frac{18}{22}=\frac{2\times 11\times 18}{3\times 12\times 22}=\frac{\cancel{2}\times \cancel{11}\times \cancel{3}\times \cancel{6}}{\cancel{3}\times \cancel{2}\times \cancel{6}\times 2\times \cancel{11}}=\frac{1}{2}$.

8. $\frac{7}{8}$ of 9 of $1\frac{1}{3}=\frac{7}{8}$ of $\frac{9}{1}$ of $\frac{4}{3}=\frac{7\times9\times4}{8\times3}=\frac{7\times\cancel{3}\times3\times\cancel{4}}{\cancel{4}\times2\times\cancel{3}}$

$$=\frac{7\times3}{2}=\frac{21}{2}.$$

9. $\frac{7}{8}$ of $7\frac{1}{3}$ of $\frac{16}{49}=\frac{7}{8}$ of $\frac{22}{3}$ of $\frac{16}{49}=\frac{7\times22\times16}{8\times3\times49}$

$$=\frac{\cancel{7}\times11\times2\times\cancel{8}\times2}{\cancel{8}\times3\times\cancel{7}\times7}=\frac{11\times2\times2}{3\times7}=\frac{44}{21}.$$

10. $2\frac{6}{7}$ of $13\frac{3}{5}$ of $7\frac{7}{10}=\frac{20}{7}$ of $\frac{68}{5}$ of $\frac{77}{10}=\frac{20\times68\times77}{7\times5\times10}$

$$=\frac{\cancel{10}\times2\times68\times\cancel{7}\times11}{\cancel{7}\times5\times\cancel{10}}=\frac{2\times68\times11}{5}=\frac{1496}{5}.$$

11. $\frac{17}{35}$ of $\frac{27}{68}$ of $29\frac{7}{8}$ of $75=\frac{17}{35}$ of $\frac{27}{68}$ of $\frac{239}{8}$ of 75

$$=\frac{17\times27\times239\times75}{35\times68\times8}=\frac{\cancel{17}\times27\times239\times\cancel{5}\times15}{\cancel{5}\times7\times4\times\cancel{17}\times8}=\frac{96795}{224}.$$

12. $\frac{35}{111}$ of 3 of $5\frac{2}{7}$ of $2\frac{11}{65}$ of $\frac{1}{1000}$

$$=\frac{35}{111}\text{ of }3\text{ of }\frac{37}{7}\text{ of }\frac{141}{65}\text{ of }\frac{1}{1000}$$

$$=\frac{35\times3\times37\times141\times1}{111\times7\times65\times1000}=\frac{\cancel{5}\times\cancel{7}\times\cancel{3}\times\cancel{37}\times141\times1}{\cancel{3}\times\cancel{37}\times\cancel{7}\times\cancel{5}\times13\times1000}$$

$$=\frac{141}{13\times1000}=\frac{141}{13000}.$$

Ex. IX. Page 19.

In each of the following Examples we divide numerator and denominator by their G. C. M.

Thus in 1. $\frac{5}{10}=\frac{5}{5\times2}=\frac{1}{2}$ (dividing by 5, the G. C. M.); or, as we shall write it in the following Examples,

$$\frac{5}{10}=\frac{5\div5}{10\div5}=\frac{1}{2}.$$

2. $\frac{12}{15}=\frac{12\div3}{15\div3}=\frac{4}{5}$.

3. $\frac{27}{36}=\frac{27\div9}{36\div9}=\frac{3}{4}$.

4. $\frac{56}{63}=\frac{56\div7}{63\div7}=\frac{8}{9}$.

5. $\frac{108}{120}=\frac{108\div12}{120\div12}=\frac{9}{10}$.

6. $\frac{24}{104}=\frac{24\div8}{104\div8}=\frac{3}{13}$.

7. $\frac{84}{228}=\frac{84\div12}{228\div12}=\frac{7}{19}$.

8. $\frac{66}{100}=\frac{66\div2}{100\div2}=\frac{33}{50}$.

9. $\frac{741}{969}=\frac{741\div57}{969\div57}=\frac{13}{17}$.

10. $\frac{374}{561}=\frac{374\div187}{561\div187}=\frac{2}{3}$.

11. $\frac{319}{407}=\frac{319\div11}{407\div11}=\frac{29}{37}$.

12. $\frac{856}{936}=\frac{856\div8}{936\div8}=\frac{107}{117}$.

13. $\frac{1729}{5850}=\frac{1729\div13}{5850\div13}=\frac{133}{450}$.

14. $\frac{176}{1000}=\frac{176\div8}{1000\div8}=\frac{22}{125}$.

15. $\frac{2023}{7581}=\frac{2023\div7}{7581\div7}=\frac{289}{1083}$.

16. $\frac{5544}{6552}=\frac{5544\div504}{6552\div504}=\frac{11}{13}$.

17. $\frac{10395}{16819}=\frac{10395\div11}{16819\div11}=\frac{945}{1529}$.

18. $\frac{80934}{110331}=\frac{80934\div123}{110331\div123}=\frac{658}{897}$.

19. $\frac{1242}{2323}=\frac{1242\div23}{2323\div23}=\frac{54}{101}$.

20. $\frac{13536}{23148}=\frac{13536\div36}{23148\div36}=\frac{376}{643}$.

Ex. X. Page 21.

1. $\frac{2}{9}$, $\frac{7}{15}$. 45 is L. C. M. of denominators;

∴ fractions become $\frac{2\times5}{9\times5}$, $\frac{7\times3}{15\times3}$, or $\frac{10}{45}$, $\frac{21}{45}$.

2. $\frac{1}{3}, \frac{5}{18}$. 18 is L. C. M. of denominators;

∴ fractions become $\frac{1\times6}{3\times6}, \frac{5}{18}$, or $\frac{6}{18}, \frac{5}{18}$.

3. $\frac{3}{7}, \frac{4}{11}$. 77 is L. C. M. of denominators;

∴ fractions become $\frac{3\times11}{7\times11}, \frac{4\times7}{11\times7}$, or $\frac{33}{77}, \frac{28}{77}$.

4. $\frac{5}{6}, \frac{8}{9}$. 18 is L. C. M. of denominators;

∴ fractions become $\frac{5\times3}{6\times3}, \frac{8\times2}{9\times2}$, or $\frac{15}{18}, \frac{16}{18}$.

5. $\frac{7}{12}, \frac{27}{28}$. 84 is L. C. M. of denominators;

∴ fractions become $\frac{5\times7}{12\times7}, \frac{27\times3}{28\times3}$, or $\frac{49}{84}, \frac{81}{84}$.

6. $\frac{5}{42}, \frac{7}{75}$. 1050 is L. C. M. of denominators;

∴ fractions become $\frac{5\times25}{42\times25}, \frac{7\times14}{75\times14}$, or $\frac{125}{1050}, \frac{98}{1050}$.

7. $\frac{3}{8}, \frac{5}{9}, \frac{7}{10}$. 360 is L. C. M. of denominators;

∴ fractions become

$\frac{3\times45}{8\times45}, \frac{5\times40}{9\times40}, \frac{7\times36}{10\times36}$, or $\frac{135}{360}, \frac{200}{360}, \frac{252}{360}$.

8. $\frac{5}{7}, \frac{7}{12}, \frac{13}{15}$. 420 is L. C. M. of denominators;

∴ fractions become

$\frac{5\times60}{7\times60}, \frac{7\times35}{12\times35}, \frac{13\times28}{15\times28}$, or $\frac{300}{420}, \frac{245}{420}, \frac{364}{420}$.

9. $\frac{2}{15}, \frac{9}{20}, \frac{7}{120}$. 120 is L. C. M. of denominators;

∴ fractions become

$$\frac{2\times 8}{15\times 8}, \frac{9\times 6}{20\times 6}, \frac{7}{120}, \text{ or } \frac{16}{120}, \frac{54}{120}, \frac{7}{120}.$$

10. $\frac{17}{18}, \frac{9}{15}, \frac{59}{60}$. 180 is L.C.M. of denominators;

∴ fractions become

$$\frac{17\times 10}{18\times 10}, \frac{9\times 12}{15\times 12}, \frac{59\times 3}{60\times 3}, \text{ or } \frac{170}{180}, \frac{108}{180}, \frac{177}{180}.$$

11. $\frac{7}{10}, \frac{7}{1000}, \frac{7}{10000}$. 10000 is L. C. M. of denominators;

∴ fractions become

$$\frac{7\times 1000}{10\times 1000}, \frac{7\times 10}{1000\times 10}, \frac{7}{10000}, \text{ or } \frac{7000}{10000}, \frac{70}{10000}, \frac{7}{10000}.$$

12. $\frac{31}{60}, \frac{13}{90}, \frac{7}{25}, \frac{4}{105}$. 6300 is L. C. M. of denominators;

∴ fractions become

$$\frac{31\times 105}{60\times 105}, \frac{13\times 70}{90\times 70}, \frac{7\times 252}{25\times 252}, \frac{4\times 60}{105\times 60},$$

$$\text{or } \frac{3255}{6300}, \frac{910}{6300}, \frac{1764}{6300}, \frac{240}{6300}.$$

13. $\frac{3}{8}, \frac{14}{15}, \frac{2}{5}, \frac{9}{22}$. 1320 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times 165}{8\times 165}, \frac{14\times 88}{15\times 88}, \frac{2\times 264}{5\times 264}, \frac{9\times 60}{22\times 60},$$

$$\text{or } \frac{495}{1320}, \frac{1232}{1320}, \frac{528}{1320}, \frac{540}{1320}.$$

14. $\frac{4}{9}, \frac{40}{99}, \frac{400}{999}, \frac{4000}{9999}$. 1109889 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{4\times123321}{9\times123321}, \frac{40\times11211}{99\times11211}, \frac{400\times1111}{999\times1111}, \frac{4000\times111}{9999\times111},$$

$$\text{or } \frac{493284}{1109889}, \frac{448440}{1109889}, \frac{444400}{1109889}, \frac{444000}{1109889}.$$

15. $\frac{81}{90}, \frac{65}{180}, \frac{49}{60}, \frac{95}{270}$. 540 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{81\times6}{90\times6}, \frac{65\times3}{180\times3}, \frac{49\times9}{60\times9}, \frac{95\times2}{270\times2},$$

$$\text{or } \frac{486}{540}, \frac{195}{540}, \frac{441}{540}, \frac{190}{540}.$$

16. $\frac{2}{3}, \frac{1}{11}, \frac{1}{21}, \frac{12}{91}, \frac{9}{143}$. 3003 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times1001}{3\times1001}, \frac{1\times273}{11\times273}, \frac{1\times143}{21\times143}, \frac{12\times33}{91\times33}, \frac{9\times21}{143\times21},$$

$$\text{or } \frac{2002}{3003}, \frac{273}{3003}, \frac{143}{3003}, \frac{396}{3003}, \frac{189}{3003}.$$

Ex. XI. Page 22.

1. (1) $\frac{2}{5}, \frac{5}{6}, \frac{7}{12}$. 60 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times12}{5\times12}, \frac{5\times10}{6\times10}, \frac{7\times5}{12\times5}, \text{ or } \frac{24}{60}, \frac{50}{60}, \frac{35}{60};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{5}{6}, \frac{7}{12}, \frac{2}{5}.$$

(2) $\frac{5}{8}, \frac{7}{9}, \frac{23}{24}$. 72 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times 9}{8\times 9}, \frac{7\times 8}{9\times 8}, \frac{23\times 3}{24\times 3}, \text{ or } \frac{45}{72}, \frac{56}{72}, \frac{69}{72};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{23}{24}, \frac{7}{9}, \frac{5}{8}.$$

(3) $\frac{3}{7}, \frac{11}{16}, \frac{23}{36}, \frac{35}{48}$. 1008 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times 144}{7\times 144}, \frac{11\times 63}{16\times 63}, \frac{23\times 28}{36\times 28}, \frac{35\times 21}{48\times 21},$$

$$\text{or } \frac{432}{1008}, \frac{693}{1008}, \frac{644}{1008}, \frac{735}{1008};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{35}{48}, \frac{11}{16}, \frac{23}{36}, \frac{3}{7}.$$

(4) $\frac{2}{9}, \frac{7}{16}, \frac{11}{24}, \frac{17}{36}$. 144 is L. C. M. of denominators;

∴ fractions become

$$\frac{2\times 16}{9\times 16}, \frac{7\times 9}{16\times 9}, \frac{11\times 6}{24\times 6}, \frac{17\times 4}{36\times 4},$$

$$\text{or } \frac{32}{144}, \frac{63}{144}, \frac{66}{144}, \frac{68}{144};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{17}{36}, \frac{11}{24}, \frac{7}{16}, \frac{2}{9}.$$

(5) $\frac{4}{7}$ of $\frac{1}{8}$ of $1\frac{2}{3}$, $\frac{5}{8}$ of $\frac{2}{9}$ of $1\frac{1}{5}$ of $\frac{7}{10}$, $\frac{16}{25}$ of $\frac{20}{32}$,

or $\frac{5}{42}, \frac{7}{60}, \frac{2}{5}$. 420 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times10}{42\times10},\ \frac{7\times7}{60\times7},\ \frac{2\times84}{5\times84},\ \text{or}\ \frac{50}{420},\ \frac{49}{420},\ \frac{168}{420};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{16}{25}\text{ of }\frac{20}{32},\ \frac{4}{7}\text{ of }\frac{1}{8}\text{ of }1\tfrac{2}{3},\ \frac{5}{8}\text{ of }\frac{2}{9}\text{ of }1\tfrac{1}{5}\text{ of }\frac{7}{20}.$$

(6) $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$, $12\frac{4}{5}$ of $5\frac{1}{6}$ of $\frac{1}{128}$, $\frac{17}{35}$,

or $\frac{7}{15}$, $\frac{31}{60}$, $\frac{17}{35}$. 420 is L. C. M. of denominators;

∴ fractions become

$$\frac{7\times28}{15\times28},\ \frac{31\times7}{60\times7},\ \frac{17\times12}{35\times12},\ \text{or}\ \frac{196}{420},\ \frac{217}{420},\ \frac{204}{420};$$

∴ in order of magnitude the fractions stand thus,

$$12\tfrac{4}{5}\text{ of }5\tfrac{1}{6}\text{ of }\frac{1}{128},\ \frac{17}{35},\ \frac{4}{5}\text{ of }\frac{6}{8}\text{ of }\frac{7}{9}.$$

(7) $\frac{14}{15}$, $\frac{18}{20}$, $\frac{19}{21}$, $\frac{24}{25}$, $\frac{29}{30}$. 200 is L. C. M. of den^s;

∴ fractions become

$$\frac{14\times140}{15\times140},\ \frac{18\times105}{20\times105},\ \frac{19\times100}{21\times100},\ \frac{24\times84}{25\times84},\ \frac{29\times70}{30\times70},$$

$$\text{or}\ \frac{1960}{2100},\ \frac{1890}{2100},\ \frac{1900}{2100},\ \frac{2016}{2100},\ \frac{2030}{2100};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{29}{30},\ \frac{24}{25},\ \frac{14}{15},\ \frac{19}{21},\ \frac{18}{20}.$$

(8) $\frac{17}{20}$, $\frac{47}{50}$, $\frac{71}{80}$, $\frac{900}{1000}$, $\frac{7777}{100000}$.

100000 is L. C. M. of denominators.

∴ fractions become

$$\frac{17\times5000}{20\times5000},\ \frac{47\times2000}{50\times2000},\ \frac{71\times1250}{80\times1250},\ \frac{900\times100}{1000\times100},\ \frac{7777}{100000},$$

$$\text{or } \frac{85000}{100000}, \frac{94000}{100000}, \frac{88750}{100000}, \frac{90000}{100000}, \frac{7777}{100000};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{47}{50}, \frac{900}{1000}, \frac{71}{80}, \frac{17}{20}, \frac{7777}{100000}.$$

(9) $\frac{2}{3}$ of $\frac{1}{4}$ of $3\frac{1}{2}$, $\frac{3}{11}$ of $1\frac{2}{9}$ of $5\frac{1}{3}$ of $\frac{1}{4}$, $\frac{13}{18}$,

or $\frac{7}{12}, \frac{4}{9}, \frac{13}{18}$. 36 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7 \times 3}{12 \times 3}, \frac{4 \times 4}{9 \times 4}, \frac{13 \times 2}{18 \times 2}, \text{ or } \frac{21}{36}, \frac{16}{36}, \frac{26}{36};$$

$\therefore$ in order of magnitude the fractions stand thus,

$\frac{13}{18}$, $\frac{2}{3}$ of $\frac{1}{4}$ of $3\frac{1}{2}$, $\frac{3}{11}$ of $1\frac{2}{9}$ of $5\frac{1}{3}$ of $\frac{1}{4}$.

(10) $\frac{11 \times 4}{5 \times 9}, \frac{12 \times 3}{4 \times 10}, \frac{10 \times 5}{6 \times 8}, \frac{11+4}{5+9}$,

or $\frac{44}{45}, \frac{9}{10}, \frac{25}{24}, \frac{15}{14}$. 2520 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{44 \times 56}{45 \times 56}, \frac{9 \times 252}{10 \times 252}, \frac{25 \times 105}{24 \times 105}, \frac{15 \times 180}{14 \times 180},$$

$$\text{or } \frac{2464}{2520}, \frac{2268}{2520}, \frac{2625}{2520}, \frac{2700}{2520};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{11+4}{5+9}, \frac{10 \times 5}{6 \times 8}, \frac{11 \times 4}{5 \times 9}, \frac{12 \times 3}{4 \times 10}.$$

2. (1) $\frac{3}{8}, \frac{7}{16}, \frac{10}{12}, \frac{11}{30}$. 240 is L. C. M. of denominators;

$\therefore$ the fractions become $\frac{3 \times 30}{8 \times 30}, \frac{7 \times 15}{16 \times 15}, \frac{10 \times 20}{12 \times 20}, \frac{11 \times 8}{30 \times 8}$,

$$\text{or } \frac{90}{240},\ \frac{105}{240},\ \frac{200}{240},\ \frac{88}{240};$$

$$\therefore\ \frac{10}{12} \text{ is the greatest, and } \frac{11}{30} \text{ the least.}$$

(2) $\frac{4}{5},\ \frac{5}{6},\ \frac{4+5}{5+6},\ \text{or } \frac{4}{5},\ \frac{5}{6},\ \frac{9}{11}.$

330 is L. C. M. of denominators;

$$\therefore \text{ fractions become } \frac{4\times 66}{5\times 66},\ \frac{5\times 55}{6\times 55},\ \frac{9\times 30}{11\times 30},$$

$$\text{or } \frac{264}{330},\ \frac{275}{330},\ \frac{270}{330};$$

$$\therefore\ \frac{5}{6} \text{ is the greatest, and } \frac{4}{5} \text{ the least.}$$

ADDITION OF VULGAR FRACTIONS.

Ex. XXI. Page 25.

1. (1) $\frac{3}{4}+\frac{5}{8}=\frac{3\times 2}{4\times 2}+\frac{5}{8}=\frac{6}{8}+\frac{5}{8}=\frac{11}{8}=1\frac{3}{8};$

$$\frac{1}{3}+\frac{5}{12}=\frac{1\times 4}{3\times 4}+\frac{5}{12}=\frac{4}{12}+\frac{5}{12}=\frac{9}{12}=\frac{3}{4};$$

$$\frac{3}{4}+\frac{5}{6}=\frac{3\times 3}{4\times 3}+\frac{5\times 2}{6\times 2}=\frac{9}{12}+\frac{10}{12}=\frac{19}{12}=1\frac{7}{12};$$

$$\frac{1}{18}+\frac{2}{63}=\frac{1\times 7}{18\times 7}+\frac{2\times 2}{63\times 2}=\frac{7}{126}+\frac{4}{126}=\frac{11}{126}.$$

(2) $\frac{3}{8}+\frac{1}{2}+\frac{2}{3}=\frac{3\times 3}{8\times 3}+\frac{1\times 12}{2\times 12}+\frac{2\times 8}{3\times 8}$

$$=\frac{9}{24}+\frac{12}{24}+\frac{16}{24}=\frac{37}{24}=1\frac{13}{24};$$

$$\frac{3}{4}+\frac{2}{9}+\frac{5}{6}=\frac{3\times 9}{4\times 9}+\frac{2\times 4}{9\times 4}+\frac{5\times 6}{6\times 6}=\frac{27}{36}+\frac{8}{36}+\frac{30}{36}$$

$$=\frac{65}{36}=1\tfrac{29}{36};$$

$$\frac{9}{10}+\frac{5}{7}+\frac{4}{9}=\frac{9\times 63}{10\times 63}+\frac{5\times 90}{7\times 90}+\frac{4\times 70}{9\times 70}$$

$$=\frac{567}{630}+\frac{450}{630}+\frac{280}{630}=\frac{1297}{630}=2\tfrac{37}{630}.$$

(3)
$$\frac{5}{6}+\frac{9}{10}+\frac{14}{15}=\frac{5\times 10}{6\times 10}+\frac{9\times 6}{10\times 6}+\frac{14\times 4}{15\times 4}=\frac{50}{60}+\frac{54}{60}+\frac{56}{60}$$

$$=\frac{160}{60}=2\tfrac{2}{3};$$

$$\frac{3}{5}+\frac{35}{80}+\frac{14}{200}=\frac{3\times 80}{5\times 80}+\frac{35\times 5}{80\times 5}+\frac{14\times 2}{200\times 2}$$

$$=\frac{240}{400}+\frac{175}{400}+\frac{28}{400}=\frac{443}{400}=1\tfrac{43}{400};$$

$$\frac{2}{3}+\frac{5}{36}+\frac{7}{720}=\frac{2\times 240}{3\times 240}+\frac{5\times 20}{36\times 20}+\frac{7}{720}$$

$$=\frac{480}{720}+\frac{100}{720}+\frac{7}{720}=\frac{587}{720}.$$

(4)
$$\frac{3}{5}+\frac{6}{7}+\frac{7}{12}+\frac{19}{28}=\frac{3\times 84}{5\times 84}+\frac{6\times 60}{7\times 60}+\frac{7\times 35}{12\times 35}+\frac{19\times 15}{28\times 15}$$

$$=\frac{252}{420}+\frac{360}{420}+\frac{245}{420}+\frac{285}{420}$$

$$=\frac{1142}{420}=2\tfrac{151}{210};$$

$$\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{9}{24}=\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{3}{8}$$

$$=\frac{7\times 16}{11\times 16}+\frac{7\times 11}{16\times 11}+\frac{5\times 8}{22\times 8}+\frac{3\times 22}{8\times 22}$$

$$=\frac{112}{176}+\frac{77}{176}+\frac{40}{176}+\frac{66}{176}$$

$$=\frac{295}{176}=1\tfrac{119}{176}.$$

(5) $$\frac{1}{3}+\frac{7}{8}+\frac{5}{6}+\frac{9}{14}+\frac{3}{28}+\frac{17}{32}$$

$$=\frac{1\times 224}{3\times 224}+\frac{7\times 84}{8\times 84}+\frac{5\times 112}{6\times 112}+\frac{9\times 48}{14\times 48}+\frac{3\times 24}{28\times 24}+\frac{17\times 21}{32\times 21}$$

$$=\frac{224}{672}+\frac{588}{672}+\frac{560}{672}+\frac{432}{672}+\frac{72}{672}+\frac{357}{672}$$

$$=\frac{2233}{672}=3\tfrac{31}{96};$$

$$\frac{31}{54}+\frac{11}{28}+\frac{53}{63}+\frac{3}{12}=\frac{31\times 14}{54\times 14}+\frac{11\times 27}{28\times 27}+\frac{53\times 12}{63\times 12}+\frac{3\times 63}{12\times 63}$$

$$=\frac{434+297+636+189}{756}$$

$$=\frac{1556}{756}=2\tfrac{11}{189}.$$

(6) $$1\tfrac{3}{8}+\frac{5}{18}+\frac{1}{6}+2\tfrac{1}{12}=1+2+\frac{3}{8}+\frac{5}{18}+\frac{1}{6}+\frac{1}{12}$$

$$=3+\frac{3\times 9}{8\times 9}+\frac{5\times 4}{18\times 4}+\frac{1\times 12}{6\times 12}+\frac{1\times 6}{12\times 6}$$

$$=3+\frac{27}{72}+\frac{20}{72}+\frac{12}{72}+\frac{6}{72}$$

$$=3+\frac{65}{72}=3\tfrac{65}{72};$$

$$7\tfrac{1}{8}+\frac{2}{3}+\frac{7}{12}+2\tfrac{5}{24}=7+2+\frac{1}{8}+\frac{2}{3}+\frac{7}{12}+\frac{5}{24}$$

$$=9+\frac{1}{8}+\frac{2}{3}+\frac{7}{12}+\frac{5}{24}$$

$$=9+\frac{1\times 6}{8\times 6}+\frac{2\times 16}{3\times 16}+\frac{7\times 4}{12\times 4}+\frac{5\times 2}{24\times 2}$$

$$=9+\frac{6}{48}+\frac{32}{48}+\frac{28}{48}+\frac{10}{48}$$

$$=9+\frac{76}{48}=9+1\tfrac{28}{48}=10\tfrac{7}{12}.$$

(7) $9\frac{1}{7}+1\frac{3}{4}+2\frac{2}{21}+4\frac{13}{24}=9+1+2+4+\frac{1}{7}+\frac{3}{5}+\frac{2}{21}+\frac{13}{24}\cdot\cdot$

$$=16+\frac{1\times24}{7\times24}+\frac{3\times42}{4\times42}+\frac{2\times8}{21\times8}+\frac{13\times7}{24\times7}$$

$$=16+\frac{24}{168}+\frac{126}{168}+\frac{16}{168}+\frac{91}{168}$$

$$=16+\frac{257}{168}=16+1\tfrac{89}{168}$$

$$=17\tfrac{89}{168};$$

$$\frac{5}{7}+2\tfrac{8}{9}+\frac{1}{16}+\frac{9}{36}+\frac{75}{63}+\frac{7}{80}$$

$$=\frac{5}{7}+2\tfrac{8}{9}+\frac{1}{16}+\frac{1}{4}+1\tfrac{4}{21}+\frac{7}{80}$$

$$=2+1+\frac{5}{7}+\frac{8}{9}+\frac{1}{16}+\frac{1}{4}+\frac{4}{21}+\frac{7}{80}$$

$$=3+\frac{5\times720}{7\times720}+\frac{8\times560}{9\times560}+\frac{1\times315}{16\times315}+\frac{1260}{4\times1260}+\frac{4\times240}{21\times240}$$
$$+\frac{7\times63}{80\times63}$$

$$=3+\frac{3600}{5040}+\frac{4480}{5040}+\frac{315}{5040}+\frac{1260}{5040}+\frac{960}{5040}+\frac{441}{5040}$$

$$=3+\frac{11056}{5040}=3+2\tfrac{61}{315}=5\tfrac{61}{315}.$$

2. (1) $10+\frac{11}{10}+\frac{11}{1000}+\frac{11}{1000000}$

$$=10+\frac{11\times100000}{10\times100000}+\frac{11\times1000}{1000\times1000}+\frac{11}{1000000}$$

$$=10+\frac{1100000+11000+11}{1000000}=10+\frac{1111011}{1000000}$$

$$=10+1\tfrac{111011}{1000000}$$

$$=11\tfrac{111011}{1000000};$$

$$35\tfrac{1}{8}+\frac{53}{12}+\frac{2}{3}\text{ of }\frac{7}{8}=35\tfrac{1}{8}+4\tfrac{5}{12}+\frac{7}{12}$$

$$=35+4+\frac{1}{8}+\frac{5}{12}+\frac{7}{12}$$

$$=39+\frac{1}{8}+\frac{12}{12}$$

$$=40+\frac{1}{8}=40\tfrac{1}{8}.$$

(2) $$\frac{18}{17}\text{ of }5\tfrac{2}{3}\text{ of }\frac{1}{27}+\frac{8}{11}\text{ of }\frac{1}{6}\text{ of }\left(\frac{1}{2}+\frac{5}{12}\right)$$

$$=\frac{18}{17}\text{ of }\frac{17}{3}\text{ of }\frac{1}{27}+\frac{8}{11}\text{ of }\frac{1}{6}\text{ of }\frac{11}{12}$$

$$=\frac{2}{9}+\frac{1}{9}=\frac{3}{9}=\frac{1}{3};$$

$$2\tfrac{3}{4}+\left(\frac{3}{5}\text{ of }7\tfrac{1}{2}\right)+7=2\tfrac{3}{4}+\frac{9}{2}+7=2\tfrac{3}{4}+4\tfrac{1}{2}+7$$

$$=2+4+7+\frac{3}{4}+\frac{1}{2}$$

$$=13+\frac{5}{4}=13+1\tfrac{1}{4}=14\tfrac{1}{4}.$$

(3) $$\frac{4}{5}\text{ of }\frac{1}{10}+\frac{3}{70}\text{ of }\left(\frac{2}{7}+\frac{4}{5}\right)+\frac{1}{7}\text{ of }\frac{5}{7}+\frac{3}{5}\text{ of }\left(\frac{1}{2}+\frac{11}{12}\right)$$

$$=\frac{2}{25}+\frac{3}{70}\text{ of }\frac{38}{35}+\frac{5}{49}+\frac{3}{5}\text{ of }\frac{17}{12}$$

$$=\frac{2}{25}+\frac{57}{35\times 35}+\frac{5}{49}+\frac{17}{20}$$

$$=\frac{2\times 196+57\times 4+5\times 100+17\times 245}{4900}$$

$$=\frac{392+228+500+4165}{4900}$$

$$=\frac{5285}{4900}=1\tfrac{11}{140}.$$

3. He sells in all $\left(2\frac{2}{3}+3\frac{3}{4}+4\frac{4}{5}+5\frac{5}{6}+6\frac{6}{7}+\frac{13}{140}\right)$ lbs.

$$=\left(20+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}+\frac{13}{140}\right)\text{ lbs.}$$

$$=\left(20+\frac{2\times140+3\times105+4\times84+5\times70+6\times60+13\times3}{420}\right)\text{ lbs.}$$

$$=\left(20+\frac{280+315+336+350+360+39}{420}\right)\text{ lbs.}$$

$$=\left(20+\frac{1680}{420}\right)\text{ lbs.}=(20+4)\text{ lbs.}=24\text{ lbs.}$$

4. Fraction $=\frac{2}{3}+\frac{5}{7}=\frac{14+15}{21}=\frac{29}{21}=1\frac{8}{21}$.

5. No. of gals. through $A=1\frac{1}{3}$ of $3\frac{1}{5}$ of $24=\frac{4}{3}$ of $\frac{16}{5}$ of 24

$$=\frac{512}{5}=102\frac{2}{5},$$

.... $B=1\frac{7}{12}$ of $1\frac{1}{5}$ of $39=\frac{19}{12}$ of $\frac{6}{5}$ of 39

$$=\frac{741}{10}=74\frac{1}{10},$$

.... $C=3\frac{1}{2}$ of $\frac{1}{7}$ of $5\frac{1}{3}$ of 44

$$=\frac{7}{2}\text{ of }\frac{1}{7}\text{ of }\frac{16}{3}\text{ of }44=\frac{352}{3}=117\frac{1}{3};$$

∴ cask contained $(102\frac{2}{5}+74\frac{1}{10}+117\frac{1}{3})$ gals.

$$=\left(293+\frac{2}{5}+\frac{1}{10}+\frac{1}{3}\right)\text{ gals.}$$

$$=\left(293+\frac{12+3+10}{30}\right)\text{ gals.}$$

$$=293\frac{5}{6}\text{ gals.}$$

SUBTRACTION OF VULGAR FRACTIONS.

Ex. XIII. Page 28.

1. (1) $$\frac{5}{6}-\frac{3}{4}=\frac{5\times 2}{6\times 2}-\frac{3\times 3}{4\times 3}=\frac{10}{12}-\frac{9}{12}=\frac{1}{12};$$

$$\frac{9}{10}-\frac{7}{8}=\frac{9\times 4}{10\times 4}-\frac{7\times 5}{8\times 5}=\frac{36}{40}-\frac{35}{40}=\frac{1}{40};$$

$$\frac{16}{20}-\frac{2}{5}=\frac{16}{20}-\frac{2\times 4}{5\times 4}=\frac{16}{20}-\frac{8}{20}=\frac{8}{20}=\frac{2}{5}.$$

(2) $$\frac{2}{7}-\frac{2}{11}=\frac{2\times 11}{7\times 11}-\frac{2\times 7}{11\times 7}=\frac{22}{77}-\frac{14}{77}=\frac{8}{77};$$

$$6-\frac{41}{7}=\frac{6\times 7}{1\times 7}-\frac{41}{7}=\frac{42}{7}-\frac{41}{7}=\frac{1}{7};$$

$$9-5\tfrac{1}{3}=\frac{9\times 3}{1\times 3}-\frac{16}{3}=\frac{27}{3}-\frac{16}{3}=\frac{11}{3}=3\tfrac{2}{3}.$$

(3) $$13\tfrac{5}{8}-7\tfrac{1}{4}=(13-7)+\left(\frac{5}{8}-\frac{1\times 2}{4\times 2}\right)=6+\frac{3}{8}=6\tfrac{3}{8};$$

$$16\tfrac{1}{2}-9\tfrac{3}{7}=(16-9)+\left(\frac{1}{2}-\frac{3}{7}\right)=7+\left(\frac{1\times 7}{14}-\frac{3\times 2}{14}\right)$$
$$=7+\frac{1}{14}=7\tfrac{1}{14};$$

$$7\tfrac{2}{3}-5\tfrac{3}{7}=(7-5)+\left(\frac{2}{3}-\frac{3}{7}\right)=2+\left(\frac{2\times 7-3\times 3}{21}\right)=2\tfrac{5}{21}.$$

(4) $$4\tfrac{5}{8}-\frac{17}{9}=\frac{37}{8}-\frac{17}{9}=\frac{37\times 9}{8\times 9}-\frac{17\times 8}{9\times 8}=\frac{333-136}{72}$$
$$=\frac{197}{72}=2\tfrac{53}{72};$$

$$27\tfrac{19}{20}-6\tfrac{9}{10}=(27-6)+\left(\frac{19}{20}-\frac{9}{10}\right)=21+\left(\frac{19}{20}-\frac{18}{20}\right)$$
$$=21\tfrac{1}{20};$$

$$16\tfrac{1}{4}-9\tfrac{3}{8}=(15-9)+\left(\frac{5}{4}-\frac{3}{8}\right)=6+\left(\frac{10}{8}-\frac{3}{8}\right)=6\tfrac{7}{8}.$$

(5) $\frac{2}{3}$ of $\frac{3}{4}=\frac{1}{2}$, $\frac{1}{2}$ of $\frac{2}{6}=\frac{1}{6}$, $\frac{1}{2}-\frac{1}{6}=\frac{3}{6}-\frac{1}{6}=\frac{2}{6}=\frac{1}{3}$;

$\frac{6}{8}$ of $24=\frac{6}{8}$ of $\frac{24}{1}=6\times 3=18$,

$\frac{6}{9}$ of $27=\frac{6}{9}$ of $\frac{27}{1}=6\times 3=18$, $18-18=0$.

(6) $9\frac{3}{16}=\frac{147}{16}$, $7\frac{5}{12}$ of $1\frac{1}{4}=\frac{89}{12}$ of $\frac{5}{4}=\frac{445}{48}$,

$$\frac{445}{48}-\frac{147}{16}=\frac{445}{48}-\frac{441}{48}=\frac{4}{48}=\frac{1}{12};$$

$\frac{1}{4}$ of $\left(2+\frac{1}{5}\right)=\frac{1}{4}$ of $\frac{11}{5}=\frac{11}{20}$,

$\frac{3}{20}$ of $(2\frac{1}{3}+3\frac{1}{2})=\frac{3}{20}$ of $5\frac{5}{6}=\frac{3}{20}$ of $\frac{35}{6}=\frac{7}{8}$,

$$\frac{7}{8}-\frac{11}{20}=\frac{35}{40}-\frac{22}{40}=\frac{13}{40}.$$

2. Number required $=1\frac{19}{40}-\frac{3}{5}=\frac{59}{40}-\frac{24}{40}=\frac{35}{40}=\frac{7}{8}$;

Number req^{d}. $=20-\left(1\frac{7}{11}+2\frac{7}{16}+3\frac{5}{22}+\frac{9}{24}\right)$

$$=20-\left(6+\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{3}{8}\right)$$

$$=20-\left(6+\frac{7\times 16}{11\times 16}+\frac{7\times 11}{16\times 11}+\frac{5\times 8}{22\times 8}+\frac{3\times 22}{8\times 22}\right)$$

$$=20-\left(6+\frac{112+77+40+66}{176}\right)$$

$$=20-\left(6+\frac{295}{176}\right)$$

$$=20-7\frac{119}{176}$$

$$=12\frac{57}{176}.$$

3. Sum of $3\frac{1}{3}$ and $2\frac{5}{6}=5+\left(\frac{1}{3}+\frac{5}{6}\right)=5+\frac{7}{6}=6\frac{1}{6}$;

difference of $3\frac{1}{3}$ and $2\frac{5}{6}=(2-2)+\left(\frac{4}{3}-\frac{5}{6}\right)=\frac{3}{6}$;

$$\therefore \text{ Ans.}=6\frac{1}{6}-\frac{3}{6}=\frac{37}{6}-\frac{3}{6}=\frac{34}{6}=5\frac{2}{3}.$$

4. After giving away $\frac{1}{2}$ of orange, representing the orange by unity or 1, $\frac{1}{2}$ remained;

$\therefore$ he gave away altogether $\left(\frac{1}{2}+\frac{1}{3}\text{ of }\frac{1}{2}\right)$ of $1=\left(\frac{1}{2}+\frac{1}{6}\right)$

$$=\left(\frac{3}{6}+\frac{1}{6}\right)=\frac{4}{6}=\frac{2}{3};$$

$\therefore$ he kept for himself $1-\frac{2}{3}=\frac{1}{3}$ of orange.

5. Amount of error$=\frac{15}{30}-\frac{15}{31}=\frac{465-450}{930}=\frac{15}{930}=\frac{1}{62}$.

6. I pay away $\frac{1}{3}$ of my money, representing the money by unity or 1;

$$\therefore 1-\frac{1}{3}\text{ or }\frac{2}{3}\text{ of money remains;}$$

I then pay away $\frac{1}{4}$ of $\frac{2}{3}$ or $\frac{1}{6}$ of my money,

$$\therefore \frac{2}{3}-\frac{1}{6}\text{ or }\frac{3}{6}\text{ or }\frac{1}{2}\text{ of money remains;}$$

I then pay away $\frac{1}{5}$ of $\frac{1}{2}$ or $\frac{1}{10}$ of my money,

$$\therefore \frac{1}{2}-\frac{1}{10}\text{ or }\frac{4}{10}\text{ or }\frac{2}{5}\text{ remains.}$$

7. *A* receives $\frac{3}{5}$ of cake, *B* receives $\frac{2}{3}$ of $\frac{3}{5}$ or $\frac{2}{5}$,

$$\therefore A \text{ has left } \frac{3}{5}-\frac{2}{5} \text{ or } \frac{1}{5};$$

C receives $\frac{3}{4}$ of $\frac{2}{5}$ or $\frac{3}{10}$, $\therefore$ *B* has left $\frac{2}{5}-\frac{3}{10}=\frac{4}{10}-\frac{3}{10}=\frac{1}{10}$;

$$\therefore A \text{ has } \frac{1}{5} \text{ left, } B\ \frac{1}{10}, \text{ and } C \text{ has } \frac{3}{10}.$$

Also *C* has $\frac{3}{10}-\frac{1}{5}=\frac{3}{10}-\frac{2}{10}=\frac{1}{10}$ more than *A*.

8. 1st woman will have travelled at 11.30 A.M. $=7\frac{1}{2}$ miles,
2nd .... $=5$ ......;

$\therefore$ they are distant from each other $2\frac{1}{2}$ miles, or five half-miles, at 11.30 A.M.

whole distance $=24$ half-miles;

$$\therefore \text{Ans.}=\frac{5}{24}.$$

MULTIPLICATION OF VULGAR FRACTIONS.

Ex. XIV. Page 31.

1. (1) $\frac{3}{6}\times\frac{3}{9}=\frac{\cancel{3}\times\cancel{3}}{\cancel{3}\times 2\times\cancel{3}\times 3}=\frac{1}{6}$;

$\frac{8}{12}\times 6=\frac{4\times\cancel{2}\times\cancel{6}}{\cancel{6}\times\cancel{2}}=4$;

$35\times\frac{5}{7}=\frac{5\times\cancel{7}\times 5}{\cancel{7}}=25$;

$15\frac{3}{4}\times 7=\frac{63\times 7}{4}=\frac{441}{4}=110\frac{1}{4}$.

(2) $16\frac{2}{3} \times \frac{4}{6}$ of $6 = \frac{50}{3} \times \frac{4}{5} \times \frac{6}{1} = \frac{\cancel{5} \times 10 \times 4 \times 2 \times \cancel{3}}{\cancel{3} \times \cancel{5}} = 80$;

$\frac{5}{9}$ of $\frac{8}{12} \times \frac{6}{7} = \frac{5 \times \cancel{4} \times 2 \times 2 \times \cancel{3}}{\cancel{3} \times 3 \times \cancel{4} \times 3 \times 7} = \frac{20}{63}$;

$2\frac{1}{3}$ of $3\frac{1}{5} \times \left(1 - \frac{17}{32}\right) = \frac{7}{3} \times \frac{16}{5} \times \frac{15}{32}$

$$= \frac{7 \times \cancel{16} \times \cancel{5} \times \cancel{3}}{\cancel{3} \times \cancel{5} \times \cancel{16} \times 2} = \frac{7}{2} = 3\frac{1}{2}.$$

(3) $\frac{3}{13}$ of $\frac{60}{81}$ of $\frac{78}{55} \times \frac{11}{12} = \frac{3 \times \cancel{12} \times \cancel{5} \times \cancel{13} \times 6 \times \cancel{11}}{\cancel{13} \times 9 \times 9 \times \cancel{5} \times \cancel{11} \times \cancel{12}}$

$$= \frac{3 \times 6}{9 \times 9}$$

$$\frac{\cancel{3} \times \cancel{3} \times 2}{\cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{2}{9};$$

$\frac{8}{15}$ of $\frac{65}{72}$ of $\frac{42}{105}$ of $\frac{81}{96} \times 6\frac{2}{13} = \frac{8}{15} \times \frac{65}{72} \times \frac{42}{105} \times \frac{81}{96} \times \frac{80}{13}$

$$= \frac{\cancel{8} \times \cancel{5} \times \cancel{13} \times 6 \times 7 \times \cancel{9} \times 9 \times 10 \times \cancel{8}}{\cancel{5} \times 3 \times \cancel{8} \times \cancel{9} \times 5 \times 21 \times \cancel{8} \times 12 \times \cancel{13}} = \frac{6 \times 7 \times 9 \times 10}{3 \times 5 \times 21 \times 12}$$

$$= \frac{2 \times \cancel{3} \times \cancel{7} \times \cancel{3} \times \cancel{3} \times 2 \times \cancel{5}}{\cancel{3} \times \cancel{5} \times \cancel{3} \times \cancel{7} \times \cancel{3} \times 4} = \frac{2 \times 2}{4} = 1;$$

$(16\frac{5}{8} - 3\frac{1}{4}) = (16 - 3) + \left(\frac{5}{8} - \frac{2}{8}\right) = 13\frac{3}{8}$;

$16\frac{5}{8} - 3\frac{1}{4}) \times 3\frac{1}{5} = 13\frac{3}{8} \times 3\frac{1}{5} = \frac{107}{8} \times \frac{16}{5}$

$$= \frac{107 \times 2}{5} = \frac{214}{5} = 42\frac{4}{5}.$$

(4) $\left(4 - \frac{3}{5}\right)$ of $\frac{11}{26} \times \frac{4}{11}$ of $\left(1 - \frac{4}{5}\right)$ of 10

$$= \frac{17}{5} \text{ of } \frac{11}{26} \times \frac{4}{11} \text{ of } \frac{1}{5} \text{ of } 10$$

$$= \frac{17 \times \cancel{11} \times 4 \times 10}{5 \times 26 \times \cancel{11} \times 5} = \frac{17 \times 4 \times \cancel{2} \times \cancel{5}}{\cancel{5} \times \cancel{2} \times 13 \times 5}$$

$$= \frac{68}{65} = 1\frac{3}{65};$$

$$\frac{5}{18} \text{ of } 2\tfrac{1}{3} \text{ of } 3\tfrac{6}{10} \times 2\tfrac{1}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{5}{18} \text{ of } \frac{7}{3} \text{ of } \frac{18}{5} \times \frac{9}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{\cancel{5} \times 7 \times \cancel{18} \times 9 \times \cancel{3} \times 2 \times 8}{\cancel{18} \times \cancel{3} \times \cancel{5} \times 4 \times 10 \times 27} = \frac{7 \times \cancel{9} \times \cancel{2} \times 2 \times \cancel{4}}{\cancel{4} \times \cancel{2} \times 5 \times \cancel{9} \times 3} = \frac{14}{15}.$$

(5) $$\frac{5}{7} \text{ of } \frac{6}{13} \text{ of } \frac{11}{15} \text{ of } \frac{1}{2} \text{ of } 29 \times \left(1 - \frac{9}{35}\right) \text{ of } \frac{6}{10} \text{ of } \frac{3}{11} \text{ of } 4\tfrac{206}{261}$$

$$= \frac{5}{7} \text{ of } \frac{6}{13} \text{ of } \frac{11}{15} \text{ of } \frac{1}{2} \text{ of } \frac{29}{1} \text{ of } \frac{26}{35} \text{ of } \frac{3}{5} \text{ of } \frac{3}{11} \text{ of } \frac{1250}{261}$$

$$= \frac{\cancel{5} \times 6 \times \cancel{11} \times 29 \times 26 \times 3 \times 3 \times 1250}{7 \times 13 \times 15 \times 2 \times 35 \times \cancel{5} \times \cancel{11} \times 261}$$

$$= \frac{\cancel{2} \times \cancel{3} \times \cancel{29} \times 2 \times \cancel{13} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times \cancel{5} \times 5 \times 5 \times 2}{7 \times \cancel{13} \times \cancel{5} \times \cancel{3} \times \cancel{2} \times \cancel{5} \times 7 \times \cancel{3} \times \cancel{3} \times \cancel{29}}$$

$$= \frac{2 \times 5 \times 5 \times 2}{7 \times 7} = \frac{100}{49} = 2\tfrac{2}{49}.$$

2. Difference $= 15\tfrac{1}{5} - \frac{1}{5} \times 15$

$= 15\tfrac{1}{5} - 3 = 12\tfrac{1}{5}$.

3. 1st fraction $= 2\tfrac{1}{3} + 5\tfrac{1}{2} = 7\tfrac{5}{6}$,
2nd .... $= 5\tfrac{1}{2} - 2\tfrac{1}{3} = 3\tfrac{1}{6}$;
sum of these fractions $= 7\tfrac{5}{6} + 3\tfrac{1}{6} = 11$,
product .... $= \frac{47}{6} \times \frac{19}{6} = \frac{893}{36} = 24\tfrac{29}{36}$;

∴ Ans. $= 24\tfrac{29}{36} - 11 = 13\tfrac{29}{36}$.

4. In one hour 1st man digs $\frac{1}{7}$ of $\frac{5}{9}$ or $\frac{5}{63}$ of piece of work,

.... 2nd .... $\frac{3}{4}$ of $\frac{5}{63}$ or $\frac{5}{84}$ ....

∴ .... both men can dig $\frac{5}{63} + \frac{5}{84}$ or $\frac{35}{252}$ ....

$\therefore$ in 4 hours both men can dig $\frac{35\times 4}{252}$ or $\frac{35}{63}$ or $\frac{5}{9}$ of piece of work;

$$\therefore \text{Ans.}=\frac{5}{9}-\frac{1}{2}=\frac{10-9}{18}=\frac{1}{18}.$$

DIVISION OF VULGAR FRACTIONS.

Ex. XV. Page 33.

1. (1) $\frac{2}{3}\div\frac{3}{5}=\frac{2}{3}\times\frac{5}{3}=\frac{2\times 5}{3\times 3}=\frac{10}{9}=1\frac{1}{9}$;

$$\frac{9}{10}\div\frac{3}{4}=\frac{9}{10}\times\frac{4}{3}=\frac{\cancel{3}\times 3\times\cancel{2}\times 2}{\cancel{2}\times 5\times\cancel{3}}=\frac{6}{5}=1\frac{1}{5};$$

$$\frac{9}{10}\div 6=\frac{9}{10}\times\frac{1}{6}=\frac{\cancel{3}\times 3}{10\times\cancel{3}\times 2}=\frac{3}{20};$$

$$6\div\frac{9}{10}=\frac{6}{1}\times\frac{10}{9}=\frac{2\times\cancel{3}\times 10}{\cancel{3}\times 3}=\frac{20}{3}=6\frac{2}{3}.$$

(2) $\frac{4}{3}\div\frac{5}{6}=\frac{4}{3}\times\frac{6}{5}=\frac{4\times 2\times\cancel{3}}{\cancel{3}\times 5}=\frac{8}{5}=1\frac{3}{5}$;

$$\frac{41}{33}\div\frac{63}{11}=\frac{41}{33}\times\frac{11}{63}=\frac{41\times\cancel{11}}{3\times\cancel{11}\times 63}=\frac{41}{189};$$

$$\frac{6}{7}\div\frac{2}{9}=\frac{6}{7}\times\frac{9}{2}=\frac{\cancel{2}\times 3\times 9}{7\times\cancel{2}}=\frac{27}{7}=3\frac{6}{7};$$

$$1\frac{5}{17}\div 11=\frac{22}{17}\times\frac{1}{11}=\frac{2\times 11}{17\times 11}=\frac{2}{17}.$$

(3) $\frac{3}{5}$ of $\frac{8}{15}\div 6\frac{1}{2}=\frac{3}{5}\times\frac{8}{15}\times\frac{2}{13}=\frac{\cancel{3}\times 8\times 2}{5\times\cancel{3}\times 5\times 13}=\frac{16}{325}$;

$$\frac{4}{7}\text{ of }16\div\frac{2}{3}\text{ of }\frac{4}{5}=\frac{4\times16}{7}\times\frac{3\times5}{2\times4}$$

$$=\frac{\cancel{4}\times\cancel{2}\times8\times3\times5}{7\times\cancel{2}\times\cancel{4}}=\frac{120}{7}=17\tfrac{1}{7};$$

$$\frac{2}{3}\text{ of }1\tfrac{3}{5}\div48=\frac{2}{3}\times\frac{8}{5}\times\frac{1}{48}=\frac{\cancel{2}\times\cancel{8}}{3\times5\times\cancel{2}\times\cancel{8}\times3}=\frac{1}{45}.$$

(4) $$\frac{23}{24}\text{ of }\frac{31}{60}\text{ of }31\tfrac{1}{2}\div\frac{22}{62}\text{ of }\frac{31}{24}\text{ of }31$$

$$=\frac{23}{\cancel{24}}\times\frac{31}{60}\times\frac{63}{2}\times\frac{62}{22}\times\frac{\cancel{24}}{31}\times\frac{1}{31}$$

$$=\frac{23\times\cancel{31}\times7\times\cancel{3}\times3\times\cancel{2}\times\cancel{31}}{\cancel{3}\times20\times\cancel{2}\times22\times\cancel{31}\times\cancel{31}}$$

$$=\frac{23\times7\times3}{20\times22}=\frac{483}{440}=1\tfrac{43}{440};$$

$$18\div\frac{5}{12}\text{ of }\frac{8}{9}\text{ of }\frac{4}{5}\text{ of }\frac{14}{25}\text{ of }1\tfrac{4}{11}$$

$$=\frac{18}{1}\times\frac{12}{5}\times\frac{9}{8}\times\frac{5}{4}\times\frac{25}{14}\times\frac{11}{15}$$

$$=\frac{\cancel{2}\times9\times\cancel{4}\times\cancel{3}\times9\times\cancel{5}\times\cancel{5}\times5\times11}{\cancel{5}\times\cancel{2}\times\cancel{4}\times4\times14\times\cancel{5}\times\cancel{3}}$$

$$=\frac{9\times9\times5\times11}{4\times14}=\frac{4455}{56}=79\tfrac{31}{56}.$$

2. (1) $$\frac{3\frac{1}{3}}{6}=\frac{\frac{10}{3}}{\frac{6}{1}}=\frac{10}{3}\times\frac{1}{6}=\frac{2\times5}{3\times3\times2}=\frac{5}{9};$$

$$\frac{6}{3\frac{1}{3}}=\frac{\frac{6}{1}}{\frac{10}{3}}=\frac{6}{1}\times\frac{3}{10}=\frac{2\times3\times3}{2\times5}=\frac{9}{5}=1\tfrac{4}{5};$$

$$\frac{\frac{1}{3}}{5\frac{3}{4}}=\frac{\frac{1}{3}}{\frac{23}{4}}=\frac{1}{3}\times\frac{4}{23}=\frac{4}{69};$$

$$\frac{13\frac{7}{8}}{19\frac{5}{6}}=\frac{\frac{111}{8}}{\frac{119}{6}}=\frac{111}{8}\times\frac{6}{119}=\frac{111\times\cancel{2}\times 3}{\cancel{2}\times 4\times 119}=\frac{333}{476};$$

$$\frac{\frac{8}{9}\times\frac{3}{4}\text{ of }\frac{2}{7}}{\frac{5}{7}}=\frac{8}{9}\times\frac{3}{4}\times\frac{2}{7}\times\frac{7}{5}=\frac{2\times\cancel{4}\times\cancel{3}\times 2\times\cancel{7}}{\cancel{3}\times 3\times\cancel{4}\times\cancel{7}\times 5}$$

$$=\frac{4}{15};$$

$$\frac{\frac{2}{3}\text{ of }\frac{6\frac{1}{7}}{9\frac{1}{3}}}{\frac{4}{7}\text{ of }\frac{2\frac{1}{3}}{9}}=\frac{\frac{2}{3}\text{ of }\frac{\frac{43}{7}}{\frac{28}{3}}}{\frac{4}{7}\text{ of }\frac{\frac{7}{3}}{9}}=\frac{\frac{2}{3}\text{ of }\frac{43}{7}\times\frac{3}{28}}{\frac{4}{7}\text{ of }\frac{7}{3}\times\frac{1}{9}}$$

$$=\frac{2\times 43\times\cancel{3}}{\cancel{3}\times 7\times 28}\times\frac{\cancel{7}\times 3\times 9}{4\times\cancel{7}\times 1}$$

$$=\frac{\cancel{2}\times 43\times 3\times 9}{7\times\cancel{2}\times 14\times 4}=2\tfrac{377}{392}.$$

(2) $$\frac{\frac{1}{3}-\frac{1}{4}}{\frac{1}{3}+\frac{1}{4}}=\frac{\frac{4-3}{12}}{\frac{4+3}{12}}=\frac{\frac{1}{12}}{\frac{7}{12}}=\frac{1\times 12}{12\times 7}=\frac{1}{7};$$

$$\frac{\frac{5}{7}-\frac{13}{49}}{\frac{1}{3}-\frac{1}{11}}=\frac{\frac{35-13}{49}}{\frac{11-3}{33}}=\frac{\frac{22}{49}}{\frac{8}{33}}=\frac{22\times 33}{49\times 8}=\frac{\cancel{2}\times 11\times 33}{49\times\cancel{2}\times 4}$$

$$=\frac{363}{196}=1\tfrac{167}{196};$$

$$\frac{8\frac{1}{5}-3\frac{1}{4}}{\frac{1}{2\frac{1}{2}}+\frac{1}{1\frac{1}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{1}{\frac{5}{2}}+\frac{1}{\frac{4}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{2}{5}+\frac{3}{4}}$$

$$=\frac{\frac{164-65}{20}}{\frac{8+15}{20}}=\frac{\frac{99}{20}}{\frac{23}{20}}$$

$$=\frac{99\times 20}{20\times 23}=\frac{99}{23}=4\tfrac{7}{23};$$

$$\frac{6\frac{1}{7}-2\frac{1}{8}}{5\frac{3}{4}+4\frac{1}{2}}\div\frac{4\frac{1}{3}+\frac{1}{7}}{5\frac{1}{7}-1\frac{1}{3}}=\frac{4\frac{1}{56}}{9\frac{5}{4}}\div\frac{4\frac{10}{21}}{3\frac{17}{21}}$$

$$=\frac{\frac{225}{56}}{\frac{41}{4}}\div\frac{\frac{94}{21}}{\frac{80}{21}}=\frac{225}{56}\times\frac{4}{41}\div\left(\frac{94}{21}\times\frac{21}{80}\right)$$

$$=\frac{225\times 4\times 80}{56\times 41\times 94}=\frac{225\times\cancel{2}\times 2\times\cancel{8}\times 10}{7\times\cancel{8}\times 41\times\cancel{2}\times 47}$$

$$=\frac{4500}{13489}.$$

(3) $$3+\frac{1}{7+\frac{1}{16}}=3+\frac{1}{\frac{7\times 16+1}{16}}=3+\frac{1}{\frac{113}{16}}$$

$$=3+\frac{16}{113}=3\tfrac{16}{113};$$

$$\frac{1}{2+\frac{1}{3+\frac{1}{4}}}=\frac{1}{2+\frac{1}{\frac{12+1}{4}}}=\frac{1}{2+\frac{4}{13}}$$

$$=\frac{1}{\frac{2\times 13+4}{13}}=\frac{13}{30};$$

$$2\tfrac{1}{2} \times \frac{1}{3\tfrac{1}{3} + \dfrac{1}{4\tfrac{1}{4}}} = \frac{5}{2} \times \frac{1}{\dfrac{10}{3} + \dfrac{1}{\frac{17}{4}}}$$

$$= \frac{5}{2} \times \frac{1}{\dfrac{10}{3} + \dfrac{4}{17}} = \frac{5}{2} \times \frac{1}{\dfrac{170+12}{51}}$$

$$= \frac{5}{2} \times \frac{51}{182} = \frac{255}{364}.$$

3. (1) $\text{Ans.} = 35 \div 10\tfrac{5}{6} = \dfrac{35}{1} \times \dfrac{6}{65} = \dfrac{\cancel{5} \times 7 \times 6}{\cancel{5} \times 13} = \dfrac{42}{13} = 3\tfrac{3}{13}.$

(2) $\text{Ans.} = \left(\dfrac{1}{12} + \dfrac{1}{4} + \dfrac{1}{8}\right) \div \left(\dfrac{1}{3} + \dfrac{1}{6} + \dfrac{1}{9}\right)$

$$= \left(\frac{2+6+3}{24}\right) \div \left(\frac{6+3+2}{18}\right)$$

$$= \frac{11}{24} \div \frac{11}{18} = \frac{11}{24} \times \frac{18}{11} = \frac{\cancel{6} \times 3}{\cancel{6} \times 4} = \frac{3}{4}.$$

4. Sum of $7\tfrac{1}{3}$ and $7\tfrac{1}{4} = 14\tfrac{7}{12}$,

difference...... $= \dfrac{1}{12}$;

$\therefore$ product $= 14\tfrac{7}{12} \times \dfrac{1}{12} = \dfrac{175}{12} \times \dfrac{1}{12}$;

$\therefore$ number required $= \dfrac{175}{12 \times 12} \div 254 = \dfrac{175}{12 \times 12 \times 254}$

$$= \frac{175}{36576}.$$

5. 35 st. $3\tfrac{1}{2}$ lbs. $= (493\tfrac{1}{2})$ lbs.;

$\therefore$ No. of parcels $= 493\tfrac{1}{2} \div 5\tfrac{7}{8}$

$$= \frac{987}{2} \times \frac{8}{47} = \frac{\cancel{47} \times 21 \times \cancel{2} \times 4}{\cancel{2} \times \cancel{47}}$$

$$= 84.$$

REDUCTION OF VULGAR FRACTIONS.

Ex. XVI. Page 38.

1. (1) $\frac{5}{8}$ of £1 $= \left(\frac{5\times 20}{8}\right)s. = \frac{25}{2}s. = 12s.\ 6d.$

$$\tfrac{3}{5}\text{ of £1} = \left(\frac{3\times 20}{5}\right)s. = 12s.$$

$$\tfrac{3}{4}\text{ of £1} = \left(\frac{3\times 20}{4}\right)s. = 15s.$$

$$\tfrac{7}{12}\text{ of }1s. = \left(\frac{7\times 12}{12}\right)d. = 7d.$$

(2) $\frac{7}{12}$ of £1 $= \left(\frac{7\times 20}{12}\right)s. = \left(\frac{7\times 5}{3}\right)s. = 11s.\ 8d.$

$$\tfrac{25}{32}\text{ of £1} = \left(\frac{25\times 20}{32}\right)s. = \left(\frac{25\times 5}{8}\right)s. = \frac{125}{8}s. = 15s.\ 7\tfrac{1}{2}d.$$

$$\tfrac{2}{3}\text{ of }10s. = \left(\frac{2\times 10}{3}\right)s. = \frac{20}{3}s. = 6s.\ 8d.$$

$$\tfrac{7}{25}\text{ of £5} = \left(\frac{7\times 5}{25}\right)£ = \frac{7}{5}£ = £1.\ 8s.$$

(3) $\frac{13}{15}$ of $2s.\ 6d. = \left(\frac{13\times 30}{15}\right)d. = (13\times 2)d. = 2s.\ 2d.$

$$\tfrac{37}{40}\text{ of }5s. = \left(\frac{37\times 5}{40}\right)s. = \frac{37}{8}s. = 4s.\ 7\tfrac{1}{2}d.$$

$$\tfrac{61}{84}\text{ of }10s.\ 6d. = \left(\frac{61\times 126}{84}\right)d. = \left(\frac{61\times 3}{2}\right)d.$$

$$= \frac{183}{2}d. = 7s.\ 7\tfrac{1}{2}d.$$

$$\left(\frac{35}{1296}\text{ of }27\right)s. = \left(\frac{35\times 27}{1296}\right)s. = \frac{35}{48}s. = \left(\frac{35\times 12}{48}\right)d.$$

$$= \frac{35}{4}d. = 8\tfrac{3}{4}d.$$

(4) $\frac{7}{8}$ cwt. $= \left(\frac{7 \times 4}{8}\right)$ qrs. $= \frac{7}{2}$ qrs. $=$ 3 qrs. 14 lbs.

$\frac{341}{720}$ lbs. Troy $= \left(\frac{341 \times 12}{720}\right)$ oz. $= \frac{341}{60}$ oz. $=$ 5 oz. $+ \frac{41}{60}$ oz.

$=$ 5 oz. $+ \frac{41 \times 20}{60}$ dwts. $=$ 5 oz. $+ \frac{41}{3}$ dwts.

$=$ 5 oz. 13 dwts. 16 grs.

$\frac{59}{64}$ ac. $= \left(\frac{59}{64} \times 4\right)$ ro. $= \frac{59}{16}$ ro. $=$ 3 ro. $+ \frac{11}{16}$ ro.

$=$ 3 ro. $+ \frac{11 \times 40}{16}$ po. $=$ 3 ro. $+ \frac{110}{4}$ po.

$=$ 3 ro. 27 po. $+ \frac{1}{2}$ po.;

and $\frac{1}{2}$ po. $= \frac{30\frac{1}{4}}{2}$ sq. yds. $= 15\frac{1}{8}$ sq. yds. $=$ 15 sq. yds. $+ \frac{9}{8}$ sq. ft.

$=$ 15 sq. yds. $1\frac{1}{8}$ sq. ft. $=$ 15 sq. yds. 1 sq. ft. 18 sq. in.

$\therefore \frac{59}{64}$ ac. $=$ 3 ro. 27 po. 15 sq. yds. 1 sq. ft. 18 sq. in.

(5) $\frac{3}{8}$ of £1. 7*s*. 6*d*. $= \frac{\text{£4. 2}s\text{. 6}d\text{.}}{8} =$ 10*s*. $3\frac{3}{4}$*d*.;

$2\frac{1}{4}$ of £1. 12*s*. 8*d*. $=$ (£1. 12*s*. 8*d*.) $\times 2 + \frac{1}{4}$ of £1. 12*s*. 8*d*.

$=$ £3. 5*s*. 4*d*. $+$ 8*s*. 2*d*. $=$ £3. 13*s*. 6*d*.;

$\frac{199}{324}$ of 2 cub. yds. $= \frac{398}{324}$ cub. yds. $=$ 1 cub. yd. $+ \frac{37}{162}$ cub. yds.

$\frac{37}{162}$ cub. yds. $= \left(\frac{37 \times 27}{162}\right)$ cub. ft. $= \frac{37}{6}$ cub. ft.

$=$ 6 cub. ft. 288 cub. in.;

$\therefore \frac{199}{324}$ of 2 cub. yds. $=$ 1 cub. yd. 6 cub. ft. 288 cub. in.

(6) $2\frac{3}{4}$ of $\frac{1}{2}$ a mile $= \frac{11}{8}$ m. $=$ 1 m. $+ \frac{3}{8}$ m. $=$ 1 m. $+ \frac{3 \times 1760}{8}$ yds.

$=$ 1 m. 660 yds.;

$$\frac{3}{7} \text{ of } 1\tfrac{2}{5} \text{ of } 2 \text{ ro. } 35 \text{ po.} = \frac{3}{7} \text{ of } \frac{7}{5} \text{ of } 115 \text{ po.} = (3 \times 23) \text{ po.}$$

$$= 69 \text{ po.} = 1 \text{ ro. } 29 \text{ po.};$$

$$\frac{5}{16} \text{ of } 5 \text{ hrs. } 25 \text{ min. } 40 \text{ sec.} = \left(\frac{5}{16} \text{ of } 19540\right) \text{sec.}$$

$$= \frac{5 \times 4885}{4} \text{ sec.} = \frac{24425}{4} \text{ sec.} = 6106\tfrac{1}{4} \text{ sec.}$$

$$= 1 \text{ hr. } 41 \text{ min. } 46\tfrac{1}{4} \text{ sec.}$$

2. (1)

	s.	d.
$\frac{3}{8}$ of $1s. = \left(\frac{3 \times 12}{8}\right)d. =$	0	$4\frac{1}{2}$
$\frac{7}{8}$ of $21s. = \frac{147}{8}s. =$	18	$4\frac{1}{2}$
$\frac{2}{5}$ of $2s.\ 6d. = \frac{5}{5}s. =$	1	0
	19	9
$\frac{3}{4}$ of $20s. = \frac{60}{4}s. =$	15	0
∴ value required =	4	9

(2)

	£	s.	d.
$\frac{7}{8}$ of £5. 10s. 6d. $= \frac{£38.\ 13s.\ 6d.}{8} =$	4	16	$8\frac{1}{4}$
$1\frac{2}{3}$ of $1\frac{1}{2}$ guins. $= \left(\frac{5}{3} \text{ of } \frac{3}{2}\right)$ guins.			
$= \left(\frac{5}{3} \text{ of } \frac{3}{2} \text{ of } 21\right)s. =$	2	12	6
	7	9	$2\frac{1}{4}$
$\frac{4}{7}$ of 2 guineas $= \left(\frac{4 \times 42}{7}\right)s. =$	1	4	0
∴ value required =	6	5	$2\frac{1}{4}$

(3)

$$\begin{array}{lrrr}
 & \pounds & s. & d. \\
\left(\frac{1}{2}+\frac{3}{4}\right)\pounds.=10s.+15s.= & 1 & 5 & 0 \\
\left(\frac{1}{3}+\frac{3}{5}\right)s.=4d.+7\frac{1}{5}d. = & 0 & 0 & 11\frac{1}{5} \\
\left(\frac{1}{4}+\frac{4}{5}\right)d. = & 0 & 0 & 0\frac{21}{20} \\
\hline
\therefore \text{ value required}= & 1 & 5 & 11\frac{25}{20} \\
 & \multicolumn{3}{r}{=\pounds1.\ 6s.\ 0\frac{1}{4}d.}
\end{array}$$

(4)

$$\begin{array}{lrrrr}
 & \text{ac.} & \text{ro.} & \text{po.} & \text{yds.} \\
1\frac{2}{3} \text{ of } 2\frac{1}{2}\text{ ac.}=\left(\frac{5}{3} \text{ of } \frac{5}{2}\right)\text{ac.}= & 4 & 0 & 26 & 20\frac{1}{6} \\
\frac{5}{8}\text{ro.}=\left(\frac{5\times40}{8}\right)\text{po.}= & 0 & 0 & 25 & 0 \\
\frac{4}{11} \text{ of } 4\frac{1}{3}\text{ po.}=\left(\frac{4\times13}{11\times3}\right)\text{po.}= & 0 & 0 & 1 & 17\frac{5}{12} \\
\hline
\therefore \text{ value required}= & 4 & 1 & 12 & 37\frac{7}{12}
\end{array}$$

$=4$ ac. 1 ro. 13 po. $7\frac{1}{3}$ yds.

(5)

$$\begin{array}{lrrrr}
 & \text{wks.} & \text{d.} & \text{hrs.} & \text{m.} \\
\frac{7}{8}\text{ of a common year}=\frac{7\times365}{8}\text{ d.}= & 45 & 4 & 9 & 0 \\
\frac{8}{9}\text{d.}=\left(\frac{8\times24}{9}\right)\text{hrs.}= & & & 21 & 20 \\
\hline
 & 45 & 5 & 6 & 20 \\
\frac{2}{3}\text{wk.}=\left(\frac{2\times7}{3}\right)\text{d.}= & & 4 & 16 & 0 \\
\hline
\therefore \text{ value required}= & 45 & 0 & 14 & 20
\end{array}$$

3. (1)

$$\begin{array}{rrrl}
\pounds & s. & d. & \\
3 & 18 & 6 & \\
 & & 10 & \\
\hline
39 & 5 & 0 & \text{for } 10 \\
 & & 10 & \\
\hline
392 & 10 & 0 & \text{for } 10\times10 \text{ or } 100 \\
 & & 7 & \\
\hline
2747 & 10 & 0 & \text{for } 100\times7 \text{ or } 700 \\
196 & 5 & 0 & \text{for } 10\times5 \text{ or } 50 \\
23 & 11 & 0 & \text{for } 6 \\
\hline
2967 & 6 & 0 & \text{for } 756 \\
3 & 5 & 5 & \text{for } \frac{5}{6} \\
\hline
2970 & 11 & 5 & \text{for } 756\frac{5}{6}
\end{array}$$

(2)

£	s.	d.	
31	2	11	
		3	
93	8	9	for 3
		6	
560	12	6	for 3 × 6 or 18
31	2	11	for 1
591	15	5	for 19
14	13	$1\frac{1}{2}\ \frac{10}{17}q.$	for $\frac{8}{17}$
606	8	$6\frac{1}{2}\ \frac{10}{17}q.$	for $19\frac{8}{17}$

(3)

£	s.	d.	
24	11	$7\frac{1}{2}$	
		4	
98	6	6	for 4
		11	
1081	11	6	for 4 × 11 or 44
49	3	3	for 2
1130	14	9	for 46
9	9	$1\frac{1}{26}$	for $\frac{5}{13}$
1140	3	$10\frac{1}{26}$	for $46\frac{5}{13}$

(4)

tons	cwt.	qrs.	lbs.	oz.	
5	13	3	24	8	
				12	
68	7	2	14	0	for 12
5	13	3	24	8	for 1
74	1	2	10	8	for 13
4	19	2	24	15	for $\frac{7}{8}$
79	1	1	7	7	for $13\frac{7}{8}$

(5)

lbs.	oz.	dwts.	
4	10	15	
		7	
34	15	5	for 7
		3	
102	9	15	for 7 × 3 or 21
2	8	$12\frac{7}{9}$	for $\frac{5}{9}$
105	6	$7\frac{7}{9}$	for $21\frac{5}{9}$

= 105 lbs. 6 oz. 7 dwts. $18\frac{2}{3}$ grs.

(6)

mi.	fur.	po.	
8	3	21	
		10	
84	3	10	for 10
2	2	$30\frac{5}{18}$	for $\frac{5}{18}$
86	6	$0\frac{5}{18}$	for $10\frac{5}{18}$

(7)

£	*s.*	*d.*	
16	11	$3\frac{7}{8}$	
		4	
66	5	$3\frac{1}{2}$	for 4
		3	
198	15	$10\frac{1}{2}$	for 4 × 3 or 12
16	11	$3\frac{7}{8}$	for 1
215	7	$2\frac{3}{8}$	for 13

= £215. 7*s.* 2¼*d.* ½*q.*

(8)

qrs.	bus.	pks.	
7	5	$3\frac{5}{9}$	
		9	
69	5	0	for 9
		4	
278	4	0	for 9 × 4 or 36
15	2	$7\frac{1}{9}$	for 2
293	7	$3\frac{1}{9}$	for 38

= 58 lds. 3 qrs. 7 bus. 3 pks. $1\frac{7}{9}$ pts.

(9)

£	*s.*	*d.*	
13	6	$10\frac{11}{32}$	
		8	
106	14	$10\frac{3}{4}$	for 8
		12	
1280	18	9	for 8 × 12 or 96
13	6	$10\frac{11}{32}$	for 1
1294	5	$7\frac{11}{32}$	for 97
12	2	$7\frac{39}{176}$	for $\frac{10}{11}$
1306	8	$2\frac{199}{352}$	for $97\frac{10}{11}$

= £1306. 8*s.* 2½*d.* $\frac{23}{352}$*q.*

(10)

ton	cwt.	qrs.	
1	13	$1\frac{35}{119}$	
		9	
14	19	$3\frac{77}{119}$	for 9
1	10	$2\frac{133}{714}$	for $\frac{11}{12}$
16	10	$1\frac{595}{714}$	for $9\frac{11}{12}$

=16 tons, 10 cwt. 1 qr. $23\frac{1}{3}$ lbs.

4.

		£	s.	d.
$23\frac{3}{4}$ yds. of calico at $10\frac{3}{4}$*d.* a yd.	=	1	1	$3\frac{5}{16}$
$135\frac{5}{8}$ yds. of sheeting at 1*s.* $9\frac{1}{2}$*d* a yd.	=	12	2	$11\frac{15}{16}$
$19\frac{5}{6}$ lbs. of beef at $7\frac{1}{4}$*d.* a lb.	=	0	11	$11\frac{19}{24}$
$14\frac{2}{3}$ lbs. of sugar at $9\frac{1}{5}$*d.* a lb.	=	0	11	$2\frac{14}{15}$
$27\frac{7}{8}$ lbs. of butter at 1*s.* $4\frac{5}{8}$*d.* a lb.	=	1	18	$7\frac{27}{64}$
		16	6	$1\frac{381}{960}$

=£16. 6*s.* $1\frac{1}{4}$*d.* $\frac{141}{240}$*q.*

5. (1)

£	s.	d.
20	16	$5\frac{1}{9}$
14	15	$0\frac{2}{7}$
5	13	$8\frac{13}{21}$
33	19	$1\frac{1}{3}$
18	3	$5\frac{5}{7}$
93	7	$9\frac{4}{63}$

$$\frac{1}{9}+\frac{2}{7}+\frac{13}{21}+\frac{1}{3}+\frac{5}{7}$$

$$=\frac{7+18+39+21+45}{63}$$

$$=\frac{130}{63}=2\tfrac{4}{63}.$$

(2)

£	s.	d.
2	0	$7\frac{2}{3}$
12	16	$0\frac{3}{4}$
4	14	$8\frac{5}{6}$
10	0	$0\frac{1}{2}$
1	7	$5\frac{3}{8}$
14	15	$7\frac{7}{12}$
45	14	$6\frac{17}{24}$

=£45. 14*s.* $6\frac{1}{2}$*d.* $\frac{5}{6}$*q.*

$$\frac{2}{3}+\frac{3}{4}+\frac{5}{6}+\frac{1}{2}+\frac{3}{8}+\frac{7}{12}$$

$$=\frac{16+18+20+12+9+14}{24}$$

$$=\frac{89}{24}=3\tfrac{17}{24}.$$

6. (1)

£	s.	d.
20	0	0
15	15	$0\frac{6}{7}$
4	4	$11\frac{1}{7}$

(2)

£	s.	d.
2163	1	$7\frac{5}{12}$
364	2	$5\frac{13}{16}$
1798	19	$1\frac{29}{48}$

=£1798. 19*s.* $1\frac{1}{2}$*d.* $\frac{5}{12}$*q.*

$$1\tfrac{5}{12}-\frac{13}{16}=\frac{17}{12}-\frac{13}{16}$$

$$=\frac{68-39}{48}=\frac{29}{48}.$$

7. (1)

$$\begin{array}{r|rrr}
 & £ & s. & d. \\
 & 20 & 6 & 7\frac{1}{2} \\
 & & & 4 \\ \hline
15\left\{\begin{array}{l}3\end{array}\right. & 81 & 6 & 6 \\ \hline
\phantom{15\{}5 & 27 & 2 & 2 \\ \hline
 & 5 & 8 & 5\frac{1}{5}
\end{array}$$

(2)

$$\begin{array}{r|rrr}
 & \text{cwt.} & \text{qrs.} & \text{lbs.} \\
 & 597 & 2 & 8 \\
 & & & 3 \\ \hline
5 & 1792 & 2 & 24 \\ \hline
8 & 358 & 2 & 4\frac{4}{5} \\ \hline
 & 44 & 3 & 7\frac{3}{5}
\end{array}$$

$= 44$ cwt. 3 qrs. 7 lbs. $9\frac{3}{5}$ oz.

Ex. XVII. Page 41.

1. (1) 3*s.* 5*d.* = 41*d.*, £1 = 240*d.*;

$$\therefore \text{ fraction} = \frac{41}{240}.$$

7*s.* $2\frac{1}{2}$*d.* = 173 halfpence, £1 = 480 halfpence;

$$\therefore \text{ fraction} = \frac{173}{480}.$$

11*d.* = 11*d.*, £1 = 240*d.*;

$$\therefore \text{ fraction} = \frac{11}{240}.$$

18*s.* $9\frac{3}{4}$*d.* = 903*q.*, £1 = 960*q.*,

$$\therefore \text{ fraction} = \frac{903}{960} = \frac{301}{320}.$$

(2) 12*s.* 6*d.* = 25 sixpences, 1 guinea = 42 sixpences;

$$\therefore \text{ fraction} = \frac{25}{42}.$$

1*s.* $0\frac{1}{4}$*d.* = 49*q.*, 1 guinea = 1008*q.*;

$$\therefore \text{ fraction} = \frac{49}{1008} = \frac{7}{144}.$$

£1. 5*s.* $8\frac{1}{4}$*d.* = 1233*q.*, 1 guinea = 1008*q.*;

$$\therefore \text{ fraction} = \frac{1233}{1008} = \frac{137}{112}.$$

(3) 13*s.* 4*d.* = 160*d.*, £2. 0*s.* 9*d.* = 489*d.*;

$$\therefore \text{ fraction} = \frac{160}{489}.$$

$6\frac{1}{2}d. = 13$ halfpence, £2. 0*s*. 9*d*. $= 978$ halfpence;

$$\therefore \text{ fraction} = \frac{13}{978}.$$

£1. 0*s*. $11\frac{3}{4}d. = 1007q.$, £2. 0*s*. $9d. = 1956q.$;

$$\therefore \text{ fraction} = \frac{1007}{1956}.$$

(4) 18*s*. 4*d*. $= 220d.$, 1 half-guinea $= 126d.$;

$$\therefore \text{ fraction} = \frac{220}{126} = \frac{110}{63}.$$

$6s.\ 3\frac{3}{7}d. = 75\frac{3}{7}d. = \frac{528}{7}d.$ 1 half-guinea $= 126d.$

$$\therefore \text{ fraction} = \frac{\frac{528}{7}}{126} = \frac{528}{7 \times 126} = \frac{264}{441}.$$

$3\frac{1}{4}$ guineas $= \left(\frac{13}{4} \times 2\right)$ half-guineas $= \frac{13}{2}$ half-guineas;

$$\therefore \text{ fraction} = \frac{\frac{13}{2}}{1} = \frac{13}{2}.$$

(5) 2 qrs. 27 lbs. $= 83$ lbs.; 1 ton $= 2240$ lbs.

$$\therefore \text{ fraction} = \frac{83}{2240}.$$

15 cwt. 13 lbs. $= 1693$ lbs.; 1 ton $= 2240$ lbs.;

$$\therefore \text{ fraction} = \frac{1693}{2240}.$$

3 tons $2\frac{1}{3}$ qrs. $= 242\frac{1}{3}$ qrs. $= \frac{727}{3}$ qrs.; 1 ton $= 80$ qrs.;

$$\therefore \text{ fraction} = \frac{\frac{727}{3}}{\frac{80}{1}} = \frac{727}{240}.$$

(6) 2 fur. 2 yds. $= 442$ yds.; 1 mile $= 1760$ yds.;

$$\therefore \text{ fraction} = \frac{442}{1760} = \frac{221}{880}.$$

30 po. 5 yds. = 170 yds.; 1 mile = 1760 yds.;

$$\therefore \text{fraction} = \frac{170}{1760} = \frac{17}{176}.$$

4 mi. 18 po. 25 in. = 257029 in.; 1 mile = 63360 in.;

$$\therefore \text{fraction} = \frac{257029}{63360}.$$

(7) 1 lb. Avoird. = 7000 grs. Troy; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{700}{576} = \frac{175}{144}.$$

6 oz. $4\frac{1}{2}$ dwts. = $124\frac{1}{2}$ dwts.; 1 lb. Troy = 240 dwts.;

$$\therefore \text{fraction} = \frac{124\frac{1}{2}}{240} = \frac{249}{480} = \frac{83}{160}.$$

18 dwts. $7\frac{1}{5}$ grs. = $439\frac{1}{5}$ grs.; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{439\frac{1}{5}}{5760} = \frac{2196}{5 \times 5760} = \frac{61}{5 \times 160} = \frac{61}{800}.$$

(8) 1 ro. 12 po. = 52 po.; $2\frac{1}{2}$ ac. = $\left(\frac{5}{2} \times 160\right)$ po. = 400 po.;

$$\therefore \text{fraction} = \frac{52}{400} = \frac{13}{100}.$$

2 ac. 2 yds. = 9682 yds.; $2\frac{1}{2}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{9682}{12100} = \frac{4841}{6050}.$$

1 ac. 3 po. $13\frac{1}{4}$ yds. = 4944 yds.; $2\frac{1}{2}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{4944}{12100} = \frac{1236}{3025}.$$

2. 1 franc = $9\frac{3}{4}$*d.*;

$$\therefore \text{fraction of £1} = \frac{9\frac{3}{4}}{240} = \frac{39}{960} = \frac{13}{320};$$

$$\therefore \text{fraction of a half sov.} = \frac{9\frac{3}{4}}{120} = \frac{39}{480} = \frac{13}{160};$$

$$\therefore \text{fraction of a crown} = \frac{9\frac{3}{4}}{60} = \frac{39}{240} = \frac{13}{80};$$

$$\therefore \text{fraction of half-a-crown} = \frac{9\frac{3}{4}}{30} = \frac{39}{120} = \frac{13}{40};$$

$$\therefore \text{ fraction of a florin} = \frac{9\frac{3}{4}}{24} = \frac{39}{96} = \frac{13}{32};$$

$$\therefore \text{ fraction of 1 shilling} = \frac{9\frac{3}{4}}{12} = \frac{39}{48} = \frac{13}{16};$$

$$\therefore \text{ fraction of sixpence} = \frac{9\frac{3}{4}}{6} = \frac{39}{24} = \frac{13}{8};$$

$$\therefore \text{ fraction of fourpence} = \frac{9\frac{3}{4}}{4} = \frac{39}{16};$$

$$\therefore \text{ fraction of threepence} = \frac{9\frac{3}{4}}{3} = \frac{39}{12} = \frac{13}{4}.$$

Again, a Napoleon $= 20$ francs $= (9\frac{3}{4} \times 20)d. = 195d.$;

$$\therefore \text{ fraction of £1} = \frac{195}{240} = \frac{13}{16};$$

$$\therefore \text{ fraction of a half sov.} = \frac{195}{120} = \frac{13}{8};$$

$$\therefore \text{ fraction of a crown} = \frac{195}{60} = \frac{13}{4};$$

$$\therefore \text{ fraction of a half-crown} = \frac{195}{30} = \frac{13}{2};$$

$$\therefore \text{ fraction of a florin} = \frac{195}{24} = \frac{65}{8};$$

$$\therefore \text{ fraction of 1 shilling} = \frac{195}{12} = \frac{65}{4};$$

$$\therefore \text{ fraction of sixpence} = \frac{195}{6} = \frac{65}{2};$$

$$\therefore \text{ fraction of fourpence} = \frac{195}{4};$$

$$\therefore \text{ fraction of threepence} = \frac{195}{3} = \frac{65}{1}.$$

3. (1) $\frac{3}{4}$ of 1*s.* 6*d.* $= \left(\frac{3}{4} \text{ of } 18\right)d.$; £1 $= 240d.$;

$$\therefore \text{ fraction} = \frac{3 \times 18}{4 \times 240} = \frac{3 \times 3}{4 \times 40} = \frac{9}{160}.$$

$\frac{8}{9}$ of half-a-crown $=\left(\frac{8}{9}\times 5\right)$ sixpences; £1 $=40$ sixpences;

$$\therefore \text{ fraction}=\frac{\frac{8\times 5}{9}}{\frac{40}{1}}=\frac{8\times 5}{9\times 40}=\frac{1}{9}.$$

(2) $\frac{3}{5}$ of 17*s.* 6*d.* $=\left(\frac{3}{5}\text{ of }35\right)$ sixpences $=21$ sixpences;

1 guinea $=42$ sixpences;

$$\therefore \text{ fraction}=\frac{21}{42}=\frac{1}{2}.$$

$\frac{4}{7}q.=\frac{4}{7}q.$, 1 guinea $=1008\,q.$;

$$\therefore \text{ fraction}=\frac{\frac{4}{7}}{\frac{1008}{1}}=\frac{4}{7\times 1008}=\frac{1}{1764}.$$

(3) $\frac{12}{25}$ of £20 $=\left(\frac{12\times 4}{5}\right)$£, £100 $=$ £100;

$$\therefore \text{ fraction}=\frac{\frac{12\times 4}{5}}{\frac{100}{1}}=\frac{12\times 4}{5\times 100}=\frac{12}{125}.$$

$\frac{3}{5}$ of $7\frac{1}{2}$ guineas $=\left(\frac{3}{5}\text{ of }\frac{15}{2}\right)$ guineas $=\frac{9}{2}$ guineas $=\left(\frac{9}{2}\times 21\right)$*s.*;

£100 $=(100\times 20)$*s.*;

$$\therefore \text{ fraction}=\frac{\frac{9\times 21}{2}}{100\times 20}=\frac{189}{4000}.$$

4. (1) $\frac{5}{9}$ of $\frac{3}{7}$ of $\frac{2}{5}$ of a yd. $=\frac{2}{21}$ yd.; 2 miles $=3520$ yds.;

$$\therefore \text{ fraction}=\frac{\frac{2}{21}}{3520}=\frac{2}{21\times 3520}=\frac{1}{21\times 1760}=\frac{1}{36960}.$$

(2) $\frac{4}{5}$ of $1\frac{5}{6}$ of $3\frac{3}{4}$ sq. yds. $=\left(\frac{4}{5} \text{ of } \frac{11}{6} \text{ of } \frac{15}{4}\right)$ sq. yds.

$=\frac{11}{2}$ sq. yds.

$\frac{4}{11}$ of 2 ac. $=\left(\frac{4}{11} \text{ of } 9680\right)$ sq. yds.

$$\therefore \text{fraction}=\frac{\frac{11}{2}}{\frac{4}{11}\times 9680}=\frac{11\times 11}{2\times 4\times 9680}=\frac{1}{640}.$$

MISCELLANEOUS EXAMPLES IN VULGAR FRACTIONS.—Ex. XVIII. Page 49.

1. (1) Ans. $=8\div\frac{1}{5}=8\times 5=40$;

Ans. $=\frac{3}{8}\div\frac{1}{5}=\frac{3}{8}\times 5=\frac{15}{8}$.

(2) Difference $=3\frac{11}{12}\div 2=\frac{47}{24}=1\frac{23}{24}$;

$\therefore$ other No. $=4\frac{7}{8}-1\frac{23}{24}=(3-1)+\left(\frac{45}{24}-\frac{23}{24}\right)=2\frac{22}{24}=2\frac{11}{12}$.

2. $\frac{5}{7}$ of distance $=1742$ m.;

$\therefore \frac{1}{7}$ of distance $=\frac{1742}{5}$ m.;

$\therefore$ distance $=\frac{1742\times 7}{5}$ m. $=\frac{12194}{5}$ m.

$=24388$ décim. $=2$ kilom. 4 hectom. 3 décam. 8 m. 8 décim.

3. $\frac{10}{12}$ or $\frac{5}{6}$ of piece of work is worth 6030*c.*;

$\therefore \frac{1}{6}$ .... $\frac{6030}{5}$*c.* or 1206*c.*;

$\therefore$ piece of work is worth 1206*c.* × 6 = 7236*c.* = 72*fr.* 36*c.*

4. (1) $\text{No.}=\frac{6}{18}-\frac{15}{63}=\frac{1}{3}-\frac{15}{63}=\frac{21-15}{63}=\frac{6}{63}=\frac{2}{21}.$

(2) $\text{No.}=365\tfrac{1}{4}\div 9\tfrac{3}{8}=\frac{1461}{4}\times\frac{8}{75}=\frac{487\times 2}{25}=\frac{974}{25}=38\tfrac{24}{25}.$

5. No. of pages remaining $=436-126=310$;

$\therefore$ fraction required $=\frac{310}{436}=\frac{155}{218}$;

excess $=\left(\frac{155}{218}-\frac{1}{3}\right)$ of 436 pages $=\frac{247}{654}$ of 436 pages

$=\frac{494}{3}$ pages $=164\tfrac{2}{3}$ pages.

6. The boy gives $\frac{1}{3}$ of cake to *A*, $\therefore\ \frac{2}{3}$ of cake remains;

.... $\frac{1}{4}$ of $\frac{2}{3}$ or $\frac{1}{6}$ of cake to *B*,

$\therefore\ \frac{2}{3}-\frac{1}{6}$, or $\frac{1}{2}$ of cake remains;

.... $\frac{1}{2}$ of $\frac{1}{2}$ or $\frac{1}{4}$ of cake to *C*,

$\therefore\ \frac{1}{2}-\frac{1}{4}$ or $\frac{1}{4}$ of cake remains;

$\therefore$ Ans. $=\left(\frac{1}{3}-\frac{1}{4}\right)$ of cake $=\frac{1}{12}$ of cake.

7.
$$\text{Ans.}=\left(\frac{1}{4}+\frac{3}{8}+\frac{5}{6}+\frac{23}{24}\right)-\left(\frac{1}{3}+\frac{2}{9}+\frac{3}{8}+\frac{5}{16}\right)$$
$$=\frac{6+9+20+23}{24}-\frac{48+32+54+45}{144}$$
$$=\frac{58}{24}-\frac{179}{144}=\frac{348-179}{144}=\frac{169}{144}=1\tfrac{25}{144}.$$

8. Portion sold $=\left(\frac{1}{5}+\frac{3}{4}\text{ of }\frac{4}{5}\right)=\frac{1}{5}+\frac{3}{5}=\frac{4}{5}$;

$\therefore\ \frac{1}{5}$ of piece of cloth $=27$ m. 54 millim. $=27054$ millim.

$\therefore$ piece of cloth $=135270$ millim.
$=135$ m. 27 centim.

9. 125 volumes cost 85 *fr.* or 8500*c.*;

$$\therefore\ 1 \text{ volume cost } \frac{8500}{125}\,c. \text{ or } 68c.$$

10. In 1 day A does $\frac{1}{2\frac{1}{2}}$ or $\frac{2}{5}$ of work;

$$\ldots\ldots\ldots\ B \text{ does } \frac{1}{3\frac{1}{3}} \text{ or } \frac{3}{10}\ \ldots\ldots\ldots$$

$$\therefore\ \ldots\ldots\ldots\ A+B \text{ do } \left(\frac{2}{5}+\frac{3}{10}\right) \text{ or } \frac{7}{10}\ \ldots\ldots\ldots$$

11. By question,

$$\text{whole sum} - \frac{1}{2}\text{ whole sum} - \frac{2}{3}\text{ of }\frac{1}{2}\text{ of whole sum} = 5s.\ 3d.;$$

$$\text{or } \left(1-\frac{1}{2}-\frac{1}{3}\right)\text{ of whole sum} = 5s.\ 3d.;$$

$$\text{or } \frac{1}{6}\text{ of whole sum} = 5s.\ 3d.;$$

$$\therefore\ \text{whole sum} = 5s.\ 3d. \times 6 = £1.\ 11s.\ 6d.;$$

∴ the money was divided thus, 15*s.* 9*d.*, 10*s.* 6*d.*, 5*s.* 3*d.*

12. There are 27 boys, and 26 girls;

$$\therefore\ \text{No. of cakes required} = \frac{1}{5}\times 26 + \left(\frac{1}{5}+\frac{1}{10}\right)\times 27$$

$$= \frac{26}{5} + \frac{81}{10} = \frac{52+81}{10} = \frac{133}{10} = 13\tfrac{3}{10}.$$

13. $\frac{3+4}{4+5}$ of $£2\frac{1}{2} = \frac{7}{9}$ of $£2\frac{1}{2} = £\left(\frac{7}{9}\times\frac{5}{2}\right) = £\frac{35}{18}$;

$\frac{3}{4}$ of $£2\frac{1}{2} = £\left(\frac{3}{4}\text{ of }\frac{5}{2}\right) = £\frac{15}{8}$;

$\frac{4}{5}$ of $£2\frac{1}{2} = £\left(\frac{4}{5}\text{ of }\frac{5}{2}\right) = £2.$

Comparing the fractions $\frac{35}{18}$ and $\frac{15}{8}$, or $\frac{140}{72}$ and $\frac{135}{72}$, we see that $\frac{4}{5}$ of £$2\frac{1}{2}$ is the greatest, and $\frac{3}{4}$ of £$2\frac{1}{2}$ is the least.

Again, $£2 - £\frac{15}{8} = £\frac{1}{8} = \frac{2512}{8}c. = 314c. = 3\,fr.\ 14c.$

14. $\frac{2}{3}$ of $\frac{3}{8}$ or $\frac{1}{4}$ of mine $=$ £2520;

$\therefore \frac{1}{8}$ of mine $= \frac{1}{2}$ of £2520 $=$ £1260;

$\therefore \frac{7}{8}$ of mine $=$ £1260 × 7 $=$ £8820.

15. (1)

$$2\frac{1}{2} + \cfrac{1}{3\frac{1}{3} + \cfrac{1}{4\frac{1}{4}}} = 2\frac{1}{2} + \cfrac{1}{\frac{10}{3} + \frac{4}{17}}$$

$$= 2\frac{1}{2} + \frac{3 \times 17}{10 \times 17 + 3 \times 4} = \frac{5}{2} + \frac{51}{182}$$

$$= \frac{455 + 51}{182} = \frac{506}{182} = 2\frac{71}{91}.$$

(2)

$$\cfrac{2}{3 + \cfrac{4}{5 + \cfrac{6}{7}}} = \cfrac{2}{3 + \cfrac{28}{41}} = \frac{2 \times 41}{3 \times 41 + 28} = \frac{82}{151}.$$

16. $1\frac{7}{12}$ or $\frac{19}{12}$ of an ac. cost £118. 13*s.*;

$\therefore$ 1 ac. cost $\frac{12}{19}$ of £118. 13*s.*;

$\therefore 10\frac{6}{7}$ or $\frac{76}{7}$ ac. cost $\left(\frac{12}{19} \text{ of } £118.\ 13s.\right) \times \frac{76}{7}$

$= (£118.\ 13s.) \times \frac{48}{7}$

$=$ £813. 12*s.*

17. At 45*c.*, weekly bill = 725*c.*;

$\therefore$ ... 1*c.*, ... $= \frac{725}{45} c.$ or $\frac{145}{9} c.$;

.... 63*c.*, ... $= \frac{145}{9} c. \times 63 = 145c. \times 7 = 1015c.$

$= 10 fr.\ 15c.$

18. 1 oz. $2\frac{1}{2}$ dwts. $= 22\frac{1}{2}$ dwts.; and 1 lb. $7\frac{1}{3}$ oz. × 6
$= 2320$ dwts.;

$22\frac{1}{2}$ or $\frac{45}{2}$ dwts. cost 7*s.* $10\frac{1}{2}d.$;

$\therefore$ 1 dwt. ..... 7*s.* $10\frac{1}{2}d. \times \frac{2}{45}$;

$\therefore$ 2320 dwts. ..... 7*s.* $10\frac{1}{2}d. \times \frac{2}{45} \times 2320$,

$= £40.\ 12s.$;

$\therefore$ value in French money $= (40\frac{3}{5} \times 2530)c.$
$= 102718c. = 1027 fr.\ 18c.$

19. $£63.\ 14s.\ 5\frac{1}{4}d. = 15293\frac{1}{4}d. = \frac{61173}{4} d.$

For every 7*d.* of income-tax he has an income of £1;

$\therefore$ .... 1*d.* .... $\frac{1}{7}$ of £1;

$\therefore$ for every $\frac{61173}{4} d.$, or £63. 14*s.* $5\frac{1}{4}d.$ of income-tax, he has an income of $\frac{1}{7} \times \frac{61173}{4}$ of £1 $= \frac{8739}{4}$ of £1 = £2184. 15*s.*

20. If $\frac{1}{5}$ of a sheep be worth $£\frac{2}{3}$,

$\therefore$ a sheep is worth $£\left(\frac{2}{3} \times 5\right)$;

$\therefore$ $\frac{3}{7}$ of a sheep, or $\frac{1}{14}$ of a bullock, is worth

$$£\left(\frac{2}{3} \times 5 \times \frac{3}{7}\right) = £\frac{10}{7};$$

$\therefore$ a bullock is worth £$\left(\frac{10}{7}\times 14\right)$ or £20;

$\therefore$ 50 bullocks are worth £20 × 50 = £1000.

21. (125 × 90) kilogs. cost 450*fr.*;

$\therefore$ 1 kilog. ..... $\frac{450}{125\times 90}$*fr.* = $\frac{1}{25}$*fr.*;

$\therefore$ (340 × 80) kilogs. ..... $\left(\frac{1}{25}\times 340\times 80\right)$*fr.* = 1088*fr.*

22. *A* receives $\frac{1}{3}$ of £13. 2*s.* 6*d.* or £4. 7*s.* 6*d.*

B .... $\frac{1}{7}$ .... £1. 17*s.* 6*d.*

£13. 2*s.* 6*d.* − (£4. 7*s.* 6*d.* + £1. 17*s.* 6*d.*) = £6. 17*s.* 6*d.*

A receives $\frac{4}{11}$ of £6. 17*s.* 6*d.* = £2. 10*s.*, and *B* receives £6. 17*s.* 6*d.* − £2. 10*s.* = £4. 7*s.* 6*d.*;

$\therefore$ *A* receives £4. 7*s.* 6*d.* + £2. 10*s.* = £6. 17*s.* 6*d.*,
and *B* .... £1. 17*s.* 6*d.* + £4. 7*s.* 6*d.* = £6. 5*s.*

23. Wheat + pasture = $\left(\frac{2}{7}+\frac{4}{9}\right)$ or $\frac{46}{63}$ of farm;

$\therefore$ $\left(1-\frac{46}{63}\right)$ or $\frac{17}{63}$ of farm = 24 ac. 2 ro. 7 po.;

$\therefore$ $\frac{1}{63}$ of farm = $\frac{1}{17}$ of 24 ac. 2 ro. 7 po., or 1 ac. 1 ro. 31 po.;

$\therefore$ farm = 1 ac. 1 ro. 31 po. × 63 = 90 ac. 3 ro. 33 po.

24 9 boys = 6 men; $\therefore$ 1 boy = $\frac{6}{9}$ or $\frac{2}{3}$ of man;

$\therefore$ 6 boys = $\left(\frac{2}{3}\times 6\right)$ men = 4 men;

$\therefore$ 13 men and 6 boys = 13 men and 4 men = 17 men.

Now 6 men can weed $\frac{1}{3}$ of field in 17 d.

$\therefore$ 6 men can weed $\frac{2}{3}$ of field in 34 d.;

$\therefore$ 1 man .... (34×6) d.

$\therefore$ 17 men .... $\frac{34 \times 6}{17}$ d. $= 12$ d.

25. No. of votes polled for winning candidate

$$=(2067-189)\div 2+189=1128;$$

$$\therefore \text{ fraction required}=\frac{1128}{2067}=\frac{376}{689}.$$

26. (1) $£8\frac{3}{5}+£8\times\frac{3}{5}=£8.\ 12s.+£4.\ 16.=£13.\ 8s.$

$$\therefore \text{ fraction required}=\frac{268}{200}=\frac{67}{50}.$$

(2) $\frac{3}{8}$ of a ton of sugar cost $£\frac{25}{2}$;

$\therefore$ 1 ton .... $£\left(\frac{25}{2}\times\frac{8}{3}\right)$, or $£\frac{100}{3}$;

$\therefore$ $1\frac{1}{3}$ .... $£\left(\frac{100}{3}\times\frac{4}{3}\right)$,

or $£44.\ 8s.\ 10\frac{1}{2}d.\ \frac{2}{3}q.$

27. In 8 days the reapers cut down $\frac{1}{3}$ of crop.

If 60 .... $\frac{1}{3}$ of crop in 8 days,

120 .... $\frac{2}{3}$ ....;

$\therefore$ 1 reaper cuts down $\frac{2}{3}$ .... (8×120) d.;

$\therefore$ 48 reapers cut down $\frac{2}{3}$ .... $\frac{8\times 120}{48}$ or 20 d.

28. 7 women make a certain no. of shirts in $7\frac{3}{5}$d. of $9\frac{7}{8}$ hr.;

$\therefore$ .... that no. × 4 .... in $(7\frac{3}{5} \times 4)$ d. of $9\frac{7}{8}$ hr.;

$\therefore$ 1 woman makes .... in $(7\frac{3}{5} \times 4 \times 7)$ d. of $9\frac{7}{8}$ hr.;

$\therefore$ .... in $(7\frac{3}{5} \times 4 \times 7 \times 9\frac{7}{8})$ d. of 1 hr.;

$\therefore$ .... in $\dfrac{7\frac{3}{5} \times 4 \times 7 \times 9\frac{7}{8}}{15\frac{4}{5}}$ d. of $15\frac{4}{5}$ hr.;

$\therefore$ 19 women make .... in $\dfrac{7\frac{3}{5} \times 4 \times 7 \times 9\frac{7}{8}}{15\frac{4}{5} \times 19}$ d. of $15\frac{4}{5}$ hr.

in 7 d. of $15\frac{4}{5}$ hr.

29. When wheat is 5*s.* a bus., 6 oz. of bread cost 1*d.*;

$\therefore$ .... 1*s.* .... $\dfrac{1}{5}$*d.*;

$\therefore$ .... 1 oz. .... $\dfrac{1}{5 \times 6}$*d.*;

$\therefore$ .... 7*s.* 6*d.* .... $\dfrac{15}{2 \times 5 \times 6}$*d.*;

$\therefore$ .... 72 oz. .... $\dfrac{15 \times 72}{2 \times 5 \times 6}$*d.*;

$=18$*d.* or 1*s.* 6*d.*

30. One pipe fills $\dfrac{1}{6}$ in 1 hr.;

the other .... $\dfrac{1}{20}$ .... ;

$\therefore$ both pipes fill $\left(\dfrac{1}{6} + \dfrac{1}{20}\right)$ or $\dfrac{13}{60}$ in 1 hr.

31. 1st pipe in 1 hr. 20 mi. would fill $\dfrac{1}{6} \times 1\frac{1}{3}$ or $\dfrac{2}{9}$ of reservoir;

$\therefore$ $\dfrac{7}{9}$ remains to be filled.

Both pipes fill $\dfrac{13}{60}$ in 1 hr.;

$\therefore$ .... $\dfrac{1}{60}$ in $\dfrac{1}{13}$ hr.;

$\therefore$ both pipes fill cistern in $\frac{60}{13}$ hr.;

$\therefore$ .... $\frac{7}{9}$ cistern in $\frac{7\times 60}{9\times 13}$ hr. $= 3\frac{23}{39}$ hr.;

$\therefore$ time required $= (1\frac{1}{3} + 3\frac{23}{39})$ hr. $= 4\frac{12}{13}$ hr.

32. $(4\frac{1}{12})s.$ or $\frac{49}{12}s.$ are worth 12 Carlini;

$\therefore$ 1*s.* is worth $\frac{12\times 12}{49}$ Carlini;

$\therefore$ 16*s.* .... $\frac{12\times 12}{49}\times 16$ Carlini;

$\therefore$ (16*s.* × 98) or 98 Nap. are worth $\frac{12\times 12\times 16\times 98}{49}$ Carlini

$= 4608$ ......

33. Representing the work by unity, or 1,

in one day A does $\frac{1}{5}$ part of the work;

.... B ...... $\frac{1}{3}$ ....

.............., C ...... $\frac{4}{9}$ ....

.... $A+B+C$ do $\left(\frac{1}{5}+\frac{1}{3}+\frac{4}{9}\right)$ or $\frac{44}{45}$ part;

$\therefore$ time in which $A+B+C$ would finish the work $= \frac{1}{\frac{44}{45}}$ d. or $\frac{45}{44}$ d.;

$\therefore$ .... $5\frac{1}{2}$ times the work $= \left(\frac{45}{44}\times\frac{11}{2}\right)$d. $= 5\frac{5}{8}$ d.

34. Representing the work by unity, or 1,

in 1 day $A+B$ do $\left(\frac{1}{15}+\frac{1}{18}\right)$ of the work;

in 3 days they do $\left(\frac{1}{15}+\frac{1}{18}\right)\times 3$ .... or $\frac{11}{30}$;

$\therefore$ $\frac{19}{30}$ of the work remains to be done.

In 3 days more *A* does $\frac{3}{15}$ or $\frac{1}{5}$ of the work;

$\therefore$ when *A* is joined by *C*, $\frac{19}{30}-\frac{1}{5}$, or $\frac{13}{30}$ of the work remains to be done.

In 4 days more *A* does $\frac{4}{15}$ of the work;

$\therefore$ work which has to be done by *C* in 4 days $=\frac{13}{30}-\frac{4}{15}=\frac{5}{30}=\frac{1}{6}$;

$\therefore$ .... *C* in 1 day $=\frac{1}{6}\div 4=\frac{1}{24}$;

$\therefore$ time in which *C* would do the whole work $=24$ days.

35. $\frac{1}{2}+\frac{1}{5}+\frac{1}{6}=\frac{13}{15}$;

$\therefore \frac{2}{15}$ of fortune $=$ £2000;

$\therefore \frac{1}{15}$ .... $=$ £1000;

$\therefore$ fortune $=$ £15000.

36. No. of oranges received by 1st boy $=\frac{1}{2}$ given no. $+1$;

$\therefore$ No. of oranges left $=\frac{1}{2}$ given no. -1 .... (1)

No. of oranges received by 2nd boy $=\frac{1}{2}$ of $\left(\frac{1}{2}\text{ given no.}-1\right)+1$

$=\frac{1}{4}$ of given no. $-\frac{1}{2}+1=\frac{1}{4}$ given no. $+\frac{1}{2}$ .... (2)

$\therefore$ No. of oranges left $=$ (1) $-$ (2)

$$=\frac{1}{2}\text{ given no.}-1-\frac{1}{4}\text{ given no.}-\frac{1}{2}$$

$$=\left(\frac{1}{2}-\frac{1}{4}\right)\text{ given no.}-\left(1+\frac{1}{2}\right)$$

$$=\frac{1}{4}\text{ given no.}-\frac{3}{2} \quad \text{.........................} \quad (3)$$

No. of oranges received by 3rd boy $=\frac{1}{2}$ of $\left(\frac{1}{4}\text{ given no.}-\frac{3}{2}\right)+1$

$$=\frac{1}{8}\text{ of given no.}-\frac{3}{4}+1=\frac{1}{8}\text{ of given no.}+\frac{1}{4}\;\ldots\ldots\ldots\;(4)$$

$\therefore$ No. of oranges left $=(3)-(4)$

$$=\frac{1}{4}\text{ of given no.}-\frac{3}{2}-\frac{1}{8}\text{ of given no.}-\frac{1}{4}$$

$$=\left(\frac{1}{4}-\frac{1}{8}\right)\text{ of given no.}-\left(\frac{3}{2}+\frac{1}{4}\right)$$

$$=\frac{1}{8}\text{ of given no.}-\frac{7}{4}\;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\;(5)$$

$\therefore$ No. of oranges received by 4th boy

$$=\frac{1}{2}\text{ of }\left(\frac{1}{8}\text{ of given no.}-\frac{7}{4}\right)+1$$

$$=\frac{1}{16}\text{ of given no.}-\frac{7}{8}+1=\frac{1}{16}\text{ of given no.}+\frac{1}{8}\;\ldots\ldots\;(6)$$

$\therefore$ No. of oranges left $=(5)-(6)$

$$=\frac{1}{8}\text{ of given no.}-\frac{7}{4}-\frac{1}{16}\text{ of given no.}-\frac{1}{8}$$

$$=\left(\frac{1}{8}-\frac{1}{16}\right)\text{ of given no.}-\left(\frac{7}{4}+\frac{1}{8}\right)$$

$$=\frac{1}{16}\text{ of given no.}-\frac{15}{8};$$

$\therefore$ by the question,

$$\frac{1}{16}\text{ of given no.}=\frac{15}{8};$$

$$\therefore\text{ given no.}=\frac{15}{8}\times 16=30.$$

37. No. of parts $=(15+3+2)=20$;

$\therefore$ quantity of Nitre $=\left(\frac{15}{20}\text{ of }100\right)$ kilog. $=75$ kilog.

.... Charcoal $=\left(\frac{3}{20}\text{ of }100\right)$ kilog. $=15$ ......

.... Sulphur $=\left(\frac{2}{20}\text{ of }100\right)$ kilog. $=10$ ......

38. When *A* gets £8, *B* gets £6, and *C* gets £5;

$\therefore$ *A* gets $\frac{8}{19}$ of £5937. 10*s*. = £2500;

B ...... $\frac{6}{19}$ of £5937. 10*s*. = £1875;

C ...... $\frac{5}{19}$ of £5937. 10*s*. = £1562. 10*s*.

39. *A*'s share = $\frac{5}{9}$ *B*'s share;

$\therefore$ *A*'s share + *B*'s share = $\frac{5}{9}$ *B*'s share + *B*'s share

= $\left(\frac{5}{9}+1\right)$ of *B*'s share

= $\frac{14}{9}$ of *B*'s share;

$\therefore$ *C*'s share = $\frac{14}{9}$ *B*'s share + 16 guineas;

$\therefore$ $\frac{14}{9}$ *B*'s share + $\frac{14}{9}$ *B*'s share = £658 − £16. 16*s*.

= £641. 4*s*.;

$\therefore$ $\frac{28}{9}$ *B*'s share = £641. 4*s*.

$\therefore$ *B*'s share = $\frac{9}{28}$ of £641. 4*s*. = £206. 2*s*.;

$\therefore$ *A*'s share = $\frac{5}{9}$ of £206. 2*s*. = £114. 10*s*.;

$\therefore$ *C*'s share = £206. 2*s*. + £114. 10*s*. + £16. 16*s*.

= £337. 8*s*.

40. The best sewer received a certain no. of shillings × 1

... 2 next .... that no. of shillings × 2 less 10*s*.

... 3 .... × 3 ... 22*s*. 6*d*.

... 10 .... × 10 ... 90*s*.

... 10 .... × 10 ... 100*s*.

... 4 .... × 4 ... 50*s*.

∴ all the sewers received a certain no. of shillings×30 less 272*s.* 6*d.*;

∴ by the question,

the no. of shillings received by best sewer × 30

$=177s.\ 6d.+272s.\ 6d.=450s.$;

∴ best sewer receives $=450s.\div30=15s.$;

∴ best sewer receives $\frac{15}{177\frac{1}{2}}$, or $\frac{6}{71}$ of whole amount,

2nd class .... $\frac{20}{177\frac{1}{2}}$, or $\frac{8}{71}$ ....

3rd .... $\frac{22\frac{1}{2}}{177\frac{1}{2}}$, or $\frac{9}{71}$ ....

4th .... $\frac{60}{177\frac{1}{2}}$, or $\frac{24}{71}$ ....

5th .... $\frac{50}{177\frac{1}{2}}$, or $\frac{20}{71}$ ....

6th .... $\frac{10}{177\frac{1}{2}}$, or $\frac{4}{71}$ ....

Now $\frac{8}{71}=\frac{4}{71}\times2$;

∴ 2nd class received twice as much as last class.

DECIMALS.—Ex. XIX. Page 57.

1. (1) $\frac{7}{10}$; $\frac{37}{100}$; $\frac{561}{1000}$; $\frac{13103}{100000}$; $\frac{450909}{1000000}$.

(2) $\cdot45=\frac{45}{100}=\frac{9}{20}$; $\cdot025=\frac{25}{1000}=\frac{1}{40}$;

$\cdot40=\frac{40}{100}=\frac{2}{5}$; $\cdot0008=\frac{8}{10000}=\frac{1}{1250}$;

$\cdot000050=\frac{50}{1000000}=\frac{1}{20000}$.

(3) $45\cdot3=\frac{453}{10}$; $4\cdot00013=\frac{400013}{100000}$;

$$796\cdot000900=\frac{796000900}{1000000}=\frac{7960009}{10000};$$

$$1000\cdot0001=\frac{10000001}{10000}.$$

2. (1) ·5 ; ·005 ; ·53 ; 343·4 ; ·0302.

(2) 2137·2 ; 300·0088 ; ·0083276 ; ·00000001.

(3) ·9 ; ·023 ; ·000001 ; 7·017 ; 200·00002.

3. Nineteen hundredths; five hundredths; five and one tenth; three and two hundred and forty-one thousandths; forty-seven thousand five hundred and sixty-one hundred thousandths; fifty thousand and twenty-five millionths; one and twenty millions and two hundred millionths.

4. $\cdot6\times10=\frac{6}{10}\times10=6$, $\cdot6\times100=\frac{6}{10}\times100=60$,

$$\cdot6\times1000=\frac{6}{10}\times1000=600,$$

$$\cdot6\times100000=\frac{6}{10}\times100000=60000;$$

$$\cdot07\times10=\frac{7}{100}\times10=\frac{7}{10}=\cdot7,$$

$$\cdot07\times100=\frac{7}{100}\times100=7,$$

$$\cdot07\times1000=\frac{7}{100}\times1000=70,$$

$$\cdot07\times100000=\frac{7}{100}\times100000=7000;$$

$$22\cdot066\times10=\frac{22066}{1000}\times10=\frac{22066}{100}=220\cdot66,$$

$$22\cdot066\times100=\frac{22066}{1000}\times100=\frac{22066}{10}=2206\cdot6,$$

$$22{\cdot}066 \times 1000 = \frac{22066}{1000} \times 1000 = 22066,$$

$$22{\cdot}066 \times 100000 = \frac{22066}{1000} \times 100000 = 22066 \times 100 = 2206600.$$

5. $$39{\cdot}045 \div 10 = \frac{39045}{1000} \times \frac{1}{10} = \frac{39045}{10000} = 3{\cdot}9045,$$

$$39{\cdot}045 \div 100 = \frac{39045}{1000} \times \frac{1}{100} = \frac{39045}{100000} = {\cdot}39045,$$

$$39{\cdot}045 \div 10000 = \frac{39045}{1000} \times \frac{1}{10000} = \frac{39045}{10000000} = {\cdot}0039045,$$

$$39{\cdot}045 \div 1000000 = \frac{39045}{1000} \times \frac{1}{1000000}$$

$$= \frac{39045}{1000000000} = {\cdot}000039045;$$

$$512{\cdot}05 \div 10 = \frac{51205}{100} \times \frac{1}{10} = \frac{51205}{1000} = 51{\cdot}205,$$

$$512{\cdot}05 \div 100 = \frac{51205}{100} \times \frac{1}{100} = \frac{51205}{10000} = 5{\cdot}1205,$$

$$512{\cdot}05 \div 10000 = \frac{51205}{100} \times \frac{1}{10000} = \frac{51205}{1000000} = {\cdot}051205,$$

$$512{\cdot}05 \div 1000000 = \frac{51205}{100} \times \frac{1}{1000000} = \frac{51205}{100000000} = {\cdot}00051205.$$

ADDITION OF DECIMALS.—Ex. XX. Page 58.

1. (1)

$$\begin{array}{r} 3{\cdot}25 \\ 42{\cdot}348 \\ 748{\cdot}4 \\ 29{\cdot}32 \\ \hline 823{\cdot}318 \end{array}$$

$$3{\cdot}25 + 42{\cdot}348 + 748{\cdot}4 + 29{\cdot}32$$

$$= \frac{325}{100} + \frac{42348}{1000} + \frac{7484}{10} + \frac{2932}{100}$$

$$= \frac{3250}{1000} + \frac{42348}{1000} + \frac{748400}{1000} + \frac{29320}{1000}$$

$$= \frac{823318}{1000} = 823{\cdot}318.$$

(2)

$$\begin{array}{r@{\cdot}l} 672 & 5 \\ 4 & 923 \\ 80 & \\ & 0764 \\ \hline 757 & 4994 \end{array}$$

$$672\cdot5+4\cdot923+80+\cdot0764$$

$$=\frac{6725}{10}+\frac{4923}{1000}+\frac{80}{1}+\frac{764}{10000}$$

$$=\frac{6725000}{10000}+\frac{49230}{10000}+\frac{800000}{10000}+\frac{764}{10000}$$

$$=\frac{7574994}{10000}=757\cdot4994.$$

(3)

$$\begin{array}{r@{\cdot}l} 72 & 5 \\ 140 & \\ 340 & 03 \\ 21 & 5715 \\ 4 & 00087 \\ \hline 578 & 10237 \end{array}$$

$$72\cdot5+140+340\cdot03+21\cdot5715+4\cdot00087$$

$$=\frac{725}{10}+\frac{140}{1}+\frac{34003}{100}+\frac{215715}{10000}+\frac{400087}{100000}$$

$$=\frac{7250000}{100000}+\frac{14000000}{100000}+\frac{34003000}{100000}+\frac{2157150}{100000}+\frac{400087}{100000}$$

$$=\frac{57810237}{100000}=578\cdot10237.$$

(4)

$$\begin{array}{r@{\cdot}l} & 96 \\ 7 & 3004 \\ 8010 & \\ & 00093 \\ 124650 & \\ \hline 132668 & 26133 \end{array}$$

$$\cdot96+7\cdot3004+8010+\cdot00093+124650$$

$$=\frac{96}{100}+\frac{73004}{10000}+\frac{8010}{1}+\frac{93}{100000}+\frac{124650}{1}$$

$$=\frac{96000}{100000}+\frac{730040}{100000}+\frac{801000000}{100000}+\frac{93}{100000}+\frac{12465000000}{100000}$$

$$=\frac{13266826133}{100000}=132668\cdot26133.$$

(5)

$$\begin{array}{r@{\cdot}l} 2 & 8146 \\ & 093845 \\ 8 & \\ & 875 \\ 231 & 2788 \\ 4 & 00875 \\ \hline 247 & 070995 \end{array}$$

$$2\cdot8146 + \cdot093845 + 8 + \cdot875 + 231\cdot2788 + 4\cdot00875$$

$$= \frac{28146}{10000} + \frac{93845}{1000000} + \frac{8}{1} + \frac{875}{1000} + \frac{2312788}{10000} + \frac{400875}{100000}$$

$$= \frac{2814600 + 93845 + 8000000 + 875000 + 231278800 + 4008750}{1000000}$$

$$= \frac{247070995}{1000000} = 247\cdot070995.$$

(6)

$$\begin{array}{r@{\cdot}l} 12 & 30046 \\ 6732 & 56 \\ & 0004 \\ 4570 & \\ 1 & 3200006 \\ \hline 11316 & 1808606 \end{array}$$

$$12\cdot30046 + 6732\cdot56 + \cdot0004 + 4570 + 1\cdot3200006$$

$$= \frac{1230046}{100000} + \frac{673256}{100} + \frac{4}{10000} + \frac{4570}{1} + \frac{13200006}{10000000}$$

$$= \frac{123004600 + 67325600000 + 4000 + 45700000000 + 13200006}{10000000}$$

$$= \frac{113161808606}{10000000} = 11316\cdot1808606.$$

(7)

$$\begin{array}{r@{\cdot}l} 8720 & 0498 \\ & 0470563 \\ 68 & 57882001 \\ 10300 & 37 \\ \hline 19089 & 04567631 \end{array}$$

$$8720{\cdot}0498+{\cdot}0470563+68{\cdot}57882001+10300{\cdot}37$$

$$=\frac{87200498}{10000}+\frac{470563}{10000000}+\frac{6857882001}{100000000}+\frac{1030037}{100}$$

$$=\frac{872004980000+4705630+6857882001+1030037000000}{100000000}$$

$$=\frac{1908904567631}{100000000}=19089{\cdot}04567631.$$

2. (1)

$$\begin{array}{r@{\cdot}l} 54&3\\ 7&29\\ 180&0046\\ 187&\\ 3&024\\ \hline 431&6186 \end{array}$$

(2)

$$\begin{array}{r@{\cdot}l} 57&038\\ 95&00487\\ 53&4690\\ 2&00003\\ 105&\\ \hline 312&51190 \end{array}$$

(3)

$$\begin{array}{r@{\cdot}l} 27&5037\\ &042\\ 342&\\ 2&1\\ 1&873592\\ 83&\\ \hline 456&519292 \end{array}$$

3. (1)

$$\begin{array}{r@{\cdot}l} 62&7\\ 2&030073\\ 460&927\\ \hline 525&657073 \end{array}$$

(2)

$$\begin{array}{r@{\cdot}l} &29\\ &00265\\ 394&1\\ 8093&000061\\ 3&0024\\ \hline 8490&395111 \end{array}$$

(3)

$$\begin{array}{r@{\cdot}l} 29000&092\\ 230004000&\\ 37&00154\\ 99000000&000099\\ 721000&00003\\ \hline 329754037&093669 \end{array}$$

SUBTRACTION OF DECIMALS.—Ex. XXI. Page 60.

1.

$$\begin{array}{r}4\cdot7\\1\cdot4\\\hline3\cdot3\end{array}\qquad\begin{array}{r}14\cdot89\\7\cdot67\\\hline7\cdot22\end{array}\qquad\begin{array}{r}25\cdot358\\14\cdot18\\\hline11\cdot178\end{array}\qquad\begin{array}{r}13\cdot4\\1\cdot27\\\hline12\cdot13\end{array}\qquad\begin{array}{r}34\cdot075\\28\cdot4069\\\hline5\cdot6681\end{array}$$

2. (1)

$$\begin{array}{r}161\cdot06\\42\cdot946\\\hline118\cdot114\end{array}$$

$$161\cdot06-42\cdot946=\frac{16106}{100}-\frac{42946}{1000}$$
$$=\frac{161060-42946}{1000}$$
$$=\frac{118114}{1000}=118\cdot11$$

(2)

$$\begin{array}{r}28\\17\cdot2463\\\hline10\cdot7537\end{array}$$

$$28-17\cdot2463=\frac{28}{1}-\frac{172463}{10000}$$
$$=\frac{280000-172463}{10000}$$
$$=\frac{107537}{10000}=10\cdot7537.$$

(3)

$$\begin{array}{r}2420\cdot6\\83\cdot450932\\\hline2337\cdot149068\end{array}$$

$$2420\cdot6-83\cdot450932=\frac{24206}{10}-\frac{83450932}{1000000}$$
$$=\frac{2420600000-83450932}{1000000}$$
$$=\frac{2337149068}{1000000}=2337\cdot149068.$$

(4)

$$\begin{array}{r}12\cdot0008\\9\cdot59\\\hline2\cdot4108\end{array}$$

$$12\cdot0008-9\cdot59=\frac{120008}{10000}-\frac{959}{100}$$
$$=\frac{120008-95900}{10000}$$
$$=\frac{24108}{10000}=2\cdot4108.$$

(5)

$$\begin{aligned}
&56{\cdot}904-6{\cdot}7996+12{\cdot}103-37{\cdot}222\\
&=50{\cdot}1044+12{\cdot}103-37{\cdot}222\\
&=62{\cdot}2074-37{\cdot}222\\
&=24{\cdot}9854.
\end{aligned}$$

$$\begin{aligned}
&56{\cdot}904-6{\cdot}7996+12{\cdot}103-37{\cdot}222\\
&=\frac{56904}{1000}-\frac{67996}{10000}+\frac{12103}{1000}-\frac{37222}{1000}\\
&=\frac{569040-67996+121030-372220}{10000}\\
&=\frac{(569040+121030)-(67996+372220)}{10000}\\
&=\frac{690070-440216}{10000}\\
&=\frac{249854}{10000}=24{\cdot}9854.
\end{aligned}$$

(6)

$$\begin{aligned}
&60{\cdot}7-({\cdot}007-{\cdot}00695437)+70{\cdot}25-25{\cdot}007\\
&=60{\cdot}7-{\cdot}00004563+70{\cdot}25-25{\cdot}007\\
&=60{\cdot}69995437+70{\cdot}25-25{\cdot}007\\
&=130{\cdot}94995437-25{\cdot}007\\
&=105{\cdot}94295437.
\end{aligned}$$

$$\begin{aligned}
&60{\cdot}7-({\cdot}007-{\cdot}00695437)+70{\cdot}25-25{\cdot}007\\
&=\frac{607}{10}-\left(\frac{7}{1000}-\frac{695437}{100000000}\right)+\frac{7025}{100}-\frac{25007}{1000}\\
&=\frac{6070000000}{100000000}-\left(\frac{700000}{100000000}-\frac{695437}{100000000}\right)+\frac{7025000000}{100000000}\\
&\qquad-\frac{2500700000}{100000000}\\
&=\frac{6070000000-4563+7025000000-2500700000}{100000000}\\
&=\frac{6069995437+7025000000-2500700000}{100000000}\\
&=\frac{13094995437-2500700000}{100000000}\\
&=\frac{10594295437}{100000000}=105{\cdot}94295437.
\end{aligned}$$

3.

$$\begin{array}{rcrcr} 6346 & \qquad & 4\cdot2 & \qquad & \cdot00005 \\ \cdot6346 & & \cdot0042 & & \cdot0000005 \\ \hline 6345\cdot3654 & & 4\cdot1958 & & \cdot0000495 \end{array}$$

4.

$$\begin{array}{rcrcr} \cdot01 & \qquad & 2\cdot9 & \qquad & 99 \\ \cdot0001 & & \cdot092 & & 9\cdot00000099 \\ \hline \cdot0099 & & 2\cdot808 & & 89\cdot99999901 \end{array}$$

5.

$$\begin{array}{rcr} 25\cdot7 & \qquad & 58 \\ 8\cdot389 & & 57\cdot145 \\ 23\cdot056 & & \cdot855 \\ \hline 57\cdot145 & & \end{array}$$

$$\text{the fraction required} = \frac{855}{1000} = \frac{171}{200}.$$

6. (1st + 2nd + 3rd) class contain ($\cdot24 + \cdot36 + \cdot18$) or $\cdot78$ of the whole no., or $\frac{78}{100}$ of the whole no.;

∴ 4th class contains whole no. $- \frac{78}{100}$ of whole no.;

∴ ………………………………… $\left(1 - \frac{78}{100}\right)$ or $\frac{22}{100}$ of the whole no.,

or $\frac{22}{100}$ of 300, or 66.

MULTIPLICATION OF DECIMALS.

Ex. XXII. Page 61.

1. (1)

$$\begin{array}{r} 24\cdot5 \\ 9 \\ \hline 220\cdot5 \end{array} \qquad 24\cdot5 \times 9 = \frac{245}{10} \times 9 = \frac{2205}{10} = 220\cdot5.$$

$$\begin{array}{r} 7\cdot2 \\ \cdot4 \\ \hline 2\cdot88 \end{array} \qquad 7\cdot2 \times \cdot4 = \frac{72}{10} \times \frac{4}{10} = \frac{288}{100} = 2\cdot88.$$

$$\begin{array}{r} \cdot48 \\ \cdot36 \\ \hline 288 \\ 144 \\ \hline \cdot1728 \end{array}$$

$$\cdot48\times\cdot36=\frac{48}{100}\times\frac{36}{100}=\frac{1728}{10000}=\cdot1728.$$

$$\begin{array}{r} 4\cdot59 \\ \cdot0003 \\ \hline \cdot001377 \end{array}$$

$$4\cdot59\times\cdot0003=\frac{459}{100}\times\frac{3}{10000}=\frac{1377}{1000000}$$
$$=\cdot001377.$$

2)
$$\begin{array}{r} \cdot034 \\ \cdot0008 \\ \hline \cdot0000272 \end{array}$$

$$\cdot034\times\cdot0008=\frac{34}{1000}\times\frac{8}{10000}$$
$$=\frac{272}{10000000}$$
$$=\cdot0000272.$$

$$\begin{array}{r} 7\cdot45 \\ 2\cdot7504 \\ \hline 2980 \\ 3725 \\ 5215 \\ 1490 \\ \hline 20\cdot490480 \\ =20\cdot49048 \end{array}$$

$$7\cdot45\times2\cdot7504=\frac{745}{100}\times\frac{27504}{10000}$$
$$=\frac{20490480}{1000000}$$
$$=20\cdot49048.$$

$$\begin{array}{r} 42\cdot200 \\ 2\cdot00400 \\ \hline 16880000 \\ 844 \\ \hline 84\cdot56880000 \\ =84\cdot5688 \end{array}$$

$$42\cdot200\times2\cdot00400=\frac{422}{10}\times\frac{2004}{1000}$$
$$=\frac{845688}{10000}$$
$$=84\cdot5688.$$

(3)
$$\begin{array}{r} 79\cdot004 \\ \cdot00473 \\ \hline 237012 \\ 553028 \\ 316016 \\ \hline \cdot37368892 \end{array}$$

$$79\cdot004\times\cdot00473$$
$$=\frac{79004}{1000}\times\frac{473}{100000}$$
$$=\frac{37368892}{100000000}$$
$$=\cdot37368892.$$

$$\begin{array}{r} 412{\cdot}5384 \\ 1{\cdot}00003 \\ \hline 12376152 \\ 4125384 \\ \hline 412{\cdot}550776152 \end{array}$$

$$412{\cdot}5384+1{\cdot}00003 = \frac{4125384}{10000}\times\frac{100003}{100000} = \frac{412550776152}{1000000000} = 412{\cdot}550776152.$$

$$\begin{array}{r} 40{\cdot}86 \\ {\cdot}0000293 \\ \hline 12258 \\ 36774 \\ 8172 \\ \hline {\cdot}001197198 \end{array}$$

$$40{\cdot}86\times{\cdot}0000293 = \frac{4086}{100}\times\frac{293}{10000000} = \frac{1197198}{1000000000} = {\cdot}001197198.$$

(4)

$$\begin{array}{r} {\cdot}000756 \\ 6{\cdot}75 \\ \hline 3780 \\ 5292 \\ 4536 \\ \hline {\cdot}00510300 \\ ={\cdot}005103 \end{array}$$

$${\cdot}000756\times6{\cdot}75=\frac{756}{1000000}\times\frac{675}{100} = \frac{5103}{1000000} = {\cdot}005103.$$

$$\begin{array}{r} {\cdot}000002897 \\ 3020 \\ \hline 57940 \\ 8691 \\ \hline {\cdot}008748940 \\ ={\cdot}00874894 \end{array}$$

$${\cdot}000002897\times3020 = \frac{2897}{1000000000}\times\frac{3020}{1} = \frac{874894}{100000000} = {\cdot}00874894.$$

$$\begin{array}{r} {\cdot}19378 \\ {\cdot}1938 \\ \hline 155024 \\ 58134 \\ 174402 \\ 19378 \\ \hline {\cdot}037554564 \end{array}$$

$${\cdot}19378\times{\cdot}1938=\frac{19378}{100000}\times\frac{1938}{10000} = \frac{37554564}{1000000000} = {\cdot}037554564.$$

2.

$$\begin{array}{r} 4\cdot2 \\ \cdot042 \\ \hline 84 \\ 168 \\ \hline \cdot1764 \\ 420 \\ \hline 35280 \\ 7056 \\ \hline 74\cdot0880 \\ \cdot0042 \\ \hline 1481760 \\ 296352 \\ \hline \cdot31116960 \\ =\cdot3111696 \end{array}$$

$$4\cdot2 \times \cdot042 \times 420 \times \cdot0042 = \frac{42}{10} \times \frac{42}{1000} \times \frac{420}{1} \times \frac{42}{10000} = \frac{3111696}{10000000} = \cdot3111696.$$

$$\begin{array}{r} 2\cdot07004 \\ \cdot07 \\ \hline \cdot1449028 \\ 500 \\ \hline 72\cdot4514000 \\ \cdot0001 \\ \hline \cdot00724514 \end{array}$$

$$2\cdot07004 \times \cdot07 \times 500 \times \cdot0001 = \frac{207004}{100000} \times \frac{7}{100} \times \frac{500}{1} \times \frac{1}{10000} = \frac{724514}{100000000} = \cdot00724514.$$

$$\begin{array}{r} 3\cdot05 \\ \cdot25 \\ \hline 1525 \\ 610 \\ \hline \cdot7625 \\ \cdot32 \\ \hline 15250 \\ 22875 \\ \hline \cdot244000 \\ \cdot231 \\ \hline 244 \\ 732 \\ 488 \\ \hline \cdot056364 \end{array}$$

$$3\cdot05 \times \cdot25 \times \cdot32 \times \cdot231 = \frac{305}{100} \times \frac{25}{100} \times \frac{32}{100} \times \frac{231}{1000} = \frac{56364}{1000000} = \cdot056364.$$

3.
$$\begin{array}{r}
7925{\cdot}648 \text{ mi.}\\
111{\cdot}454\phantom{\text{ mi.}}\\
\hline
31702592\phantom{\text{ mi.}}\\
39628240\phantom{\text{ mi.}}\\
31702592\phantom{\text{ mi.}}\\
7925648\phantom{\text{ mi.}}\\
7925648\phantom{\text{ mi.}}\\
7925648\phantom{\text{ mi.}}\\
\hline
883345{\cdot}172192 \text{ mi.}
\end{array}
\qquad
\begin{array}{r}
883345{\cdot}172192 \text{ mi.}\\
3{\cdot}14159\phantom{\text{ mi.}}\\
\hline
7950106549728\phantom{\text{ mi.}}\\
4416725860960\phantom{\text{ mi.}}\\
883345172192\phantom{\text{ mi.}}\\
3533380688768\phantom{\text{ mi.}}\\
883345172192\phantom{\text{ mi.}}\\
2650035516576\phantom{\text{ mi.}}\\
\hline
2775108{\cdot}35950666528 \text{ mi.}
\end{array}$$

DIVISION OF DECIMALS.—Ex. XXIII. Page 65.

1. (1)
$$\begin{array}{r}
38)\,15{\cdot}96\,(\,{\cdot}42\\
152\phantom{\,(\,{\cdot}42}\\
\hline
76\phantom{\,(\,{\cdot}42}\\
76\phantom{\,(\,{\cdot}42}\\
\hline
\end{array}$$

$$15{\cdot}96 \div 38 = \frac{1596}{100} \times \frac{1}{38}$$
$$= \frac{1596}{38} \times \frac{1}{100}$$
$$= \frac{42}{100} = {\cdot}42.$$

$$3{\cdot}8)\,1{\cdot}596\,(\,{\cdot}42$$

$$1{\cdot}596 \div 3{\cdot}8 = \frac{1596}{1000} \times \frac{10}{38}$$
$$= \frac{1596}{38} \times \frac{10}{1000}$$
$$= \frac{42}{100} = {\cdot}42.$$

$${\cdot}038)\,1{\cdot}596\,(\,42$$

$$1{\cdot}596 \div {\cdot}038 = \frac{1596}{1000} \times \frac{1000}{38}$$
$$= \frac{1596}{38} = 42.$$

$${\cdot}38)\,1596{\cdot}00\,(\,4200$$

$$1596 \div {\cdot}38 = \frac{1596}{1} \times \frac{100}{38}$$
$$= \frac{1596}{38} \times 100$$
$$= 42 \times 100 = 4200.$$

(2) ·53) 17·1031 (32·27
159
120
106
143
106
371
371

$$17{\cdot}1031 \div {\cdot}53 = \frac{171031}{10000} \times \frac{100}{53}$$
$$= \frac{171031}{53} \times \frac{1}{100}$$
$$= \frac{3227}{100} = 32{\cdot}27.$$

·0053) 17·1031 (3227

$$17{\cdot}1031 \div {\cdot}0053 = \frac{171031}{10000} \times \frac{10000}{53}$$
$$= \frac{171031}{53} = 3227.$$

53) 17·1031 (·3227

$$17{\cdot}1031 \div 53 = \frac{171031}{10000} \times \frac{1}{53}$$
$$= \frac{171031}{53} \times \frac{1}{10000}$$
$$= \frac{3227}{10000} = {\cdot}3227.$$

·000053) 17·103100 (322700

$$17{\cdot}1031 \div {\cdot}000053$$
$$= \frac{171031}{10000} \times \frac{1000000}{53}$$
$$= \frac{171031}{53} \times 100$$
$$= 3227 \times 100 = 322700.$$

(3) 4·07) 3·72812 (·916
3663
651
407
2442
2442

$$3{\cdot}72812 \div 4{\cdot}07$$
$$= \frac{372812}{100000} \times \frac{100}{407}$$
$$= \frac{372812}{407} \times \frac{1}{1000}$$
$$= \frac{916}{1000} = {\cdot}916.$$

$\cdot407\,)\;372\cdot812\;(916$

$$\begin{aligned}372\cdot812 \div \cdot407 &= \frac{372812}{1000} \times \frac{1000}{407}\\ &= \frac{372812}{407} = 916.\end{aligned}$$

$\cdot000407\,)\;37281\cdot200000\;(91600000$

$$\begin{aligned}37281\cdot2 \div \cdot000407 &= \frac{372812}{10} \times \frac{1000000}{407}\\ &= \frac{372812}{407} \times 100000\\ &= 916 \times 100000 = 91600000.\end{aligned}$$

(4) $$\begin{array}{r}1\cdot25\,)\;1\cdot000\;(\cdot8\\ \underline{1000}\end{array}$$

$$\begin{aligned}1 \div 1\cdot25 = 1 \times \frac{100}{125} &= \frac{1000}{125} \times \frac{1}{10}\\ &= \frac{8}{10} = \cdot8.\end{aligned}$$

$$\begin{array}{r}\cdot005\,)\;\cdot0120\;(2\cdot4\\ 10\\ \hline 20\\ \underline{20}\end{array}$$

$$\begin{aligned}\cdot012 \div \cdot005 = \frac{12}{1000} \times \frac{1000}{5} &= \frac{120}{5} \times \frac{1}{10}\\ &= \frac{24}{10} = 2\cdot4.\end{aligned}$$

$\cdot0002\,)\;2\cdot0000\;(10000$

$$\begin{aligned}2 \div \cdot0002 &= \frac{2}{1} \times \frac{10000}{2}\\ &= \frac{2}{2} \times 10000\\ &= 1 \times 10000\\ &= 10000.\end{aligned}$$

$10000000\,)\;703\cdot40000000\;(\cdot00007034$

$$\begin{aligned}703\cdot4 \div 10000000 = \frac{7034}{10} \times \frac{1}{10000000} &= \frac{7034}{100000000}\\ &= \cdot00007034.\end{aligned}$$

(5) 7·85) 36·25130 (4·618
3140
4851
4710
1413
785
6280
6280

$$36{\cdot}2513 \div 7{\cdot}85 = \frac{362513}{10000}\times\frac{100}{785} = \frac{3625130}{785}\times\frac{1}{1000} = \frac{4618}{1000} = 4{\cdot}618.$$

562·73) ·0450184 (·00008
450184

$$\cdot 0450184 \div 562{\cdot}73 = \frac{450184}{10000000}\times\frac{100}{56273} = \frac{450184}{56273}\times\frac{1}{100000} = \frac{8}{100000} = \cdot 00008.$$

2·00099) 218051·081884 (108971·6
200099
1795208
1600792
1944161
1800891
1432708
1400693
320158
200099
1200594
1200594

$$218051{\cdot}081884 \div 2{\cdot}00099 = \frac{218051081884}{1000000}\times\frac{100000}{200099} = \frac{218051081884}{200099}\times\frac{1}{10} = \frac{1089716}{10} = 108971{\cdot}6.$$

(6) 6·056) ·055757592 (·009207
54504
12535
12112
42392
42392

$$\cdot 055757592 \div 6{\cdot}056 = \frac{55757592}{1000000000}\times\frac{1000}{6056} = \frac{55757592}{6056}\times\frac{1}{1000000} = \frac{9207}{1000000} = \cdot 009207.$$

3020) 8·748940 (·002897
6040
27089
24160
29294
27180
21140
21140

$$8{\cdot}74894 \div 3020 = \frac{874894}{100000} \times \frac{1}{3020} = \frac{874894}{302} \times \frac{1}{1000000} = \frac{2897}{1000000} = {\cdot}002897.$$

·0302) 8·74894 (289·7

$$8{\cdot}74894 \div {\cdot}0302 = \frac{874894}{100000} \times \frac{10000}{302} = \frac{874894}{302} \times \frac{1}{10} = \frac{2897}{10} = 289{\cdot}7.$$

(7) 710·1) ·64619391141 (·0009100041
63909
7103
7101
29114
28404
7101
7101

$${\cdot}64619391141 \div 710{\cdot}1 = \frac{64619391141}{100000000000} \times \frac{10}{7101} = \frac{64619391141}{7101} \times \frac{1}{10000000000} = \frac{9100041}{10000000000} = {\cdot}0009100041.$$

·00693) 2547052·20000 (367540000
2079
4680
4158
5225
4851
3742
3465
2772
2772

$$2547052{\cdot}2 \div {\cdot}00693 = \frac{25470522}{10} \times \frac{100000}{693} = \frac{25470522}{693} \times \frac{100000}{10} = 36754 \times 10000 = 367540000.$$

693) 2547052·2 (3675·4

$$2547052{\cdot}2 \div 693$$

$$= \frac{25470522}{10} \times \frac{1}{693}$$

$$= \frac{25470522}{693} \times \frac{1}{10}$$

$$= \frac{36754}{10} = 3675{\cdot}4.$$

(8) ·0089) 65·06612089 (7310·8001
623
276
267
96
89
712
712
089
89

$$65{\cdot}06612089 \div {\cdot}0089$$

$$= \frac{6506612089}{100000000} \times \frac{10000}{89}$$

$$= \frac{6506612089}{89} \times \frac{10000}{100000000}$$

$$= \frac{73108001}{10000} = 7310{\cdot}8001.$$

8·9) 65·06612089 (7·3108001

$$65{\cdot}06612089 \div 8{\cdot}9$$

$$= \frac{6506612089}{100000000} \times \frac{10}{89}$$

$$= \frac{6506612089}{89} \times \frac{1}{10000000}$$

$$= \frac{73108001}{10000000}$$

$$= 7{\cdot}3108001$$

89000) 65·06612089000 (·00073108001

$$65{\cdot}06612089 \div 89000$$

$$= \frac{6506612089}{100000000} \times \frac{1}{89000}$$

$$= \frac{6506612089}{89} \times \frac{1}{100000000000}$$

$$= \frac{73108001}{100000000000}$$

$$= {\cdot}00073108001.$$

(9) $\cdot 001 \div (1 \times \cdot 01 \times 100) = \frac{1}{1000} \div \left(1 \times \frac{1}{100} \times 100\right) = \frac{1}{1000} = \cdot 001;$

$$\begin{aligned}
\cdot 20736 \div (1\cdot 2 \times \cdot 012 \times 120) &= \frac{20736}{100000} \div \left(\frac{12}{10} \times \frac{12}{1000} \times \frac{120}{1}\right) \\
&= \frac{20736}{100000} \times \frac{10}{12} \times \frac{1000}{12} \times \frac{1}{120} \\
&= \frac{20736}{12 \times 12 \times 12} \times \frac{1}{100} \\
&= \frac{12}{100} = \cdot 12.
\end{aligned}$$

$$\begin{array}{r}
76\cdot 8 \\
\cdot 0987 \\
\hline
5376 \\
6144 \\
6912 \\
\hline
7\cdot 58016
\end{array}
\qquad\qquad
\begin{array}{r}
7\cdot 58016 \,)\, 98\cdot 8452864 \,(\, 13\cdot 04 \\
758016 \\
\hline
2304368 \\
2274048 \\
\hline
3032064 \\
3032064 \\
\hline
\end{array}$$

$$\begin{aligned}
&98\cdot 8452864 \div (76\cdot 8 \times \cdot 0987) \\
&= \frac{988452864}{10000000} \times \frac{10}{768} \times \frac{10000}{987} \\
&= \frac{988452864}{758016} \times \frac{1}{100} \\
&= \frac{1304}{100} = 13\cdot 04.
\end{aligned}$$

(10) $1\cdot 4 \times \cdot 015 = \cdot 021;$

$$\begin{array}{r}
\cdot 00014 \,)\, \cdot 02100 \,(\, 150 \\
14 \\
\hline
70 \\
70 \\
\hline
\end{array}$$

$$\begin{aligned}
&1\cdot 4 \times \cdot 015 \div \cdot 00014 \\
&= \frac{14}{10} \times \frac{15}{1000} \times \frac{100000}{14} = 15 \times 10 = 150;
\end{aligned}$$

$$\begin{aligned}&143{\cdot}507702 \div (107{\cdot}8 + 6{\cdot}541 - 31{\cdot}96)\\ =\;&143{\cdot}507702 + (114{\cdot}341 - 31{\cdot}96)\\ =\;&143{\cdot}507702 \div 82{\cdot}381;\end{aligned}$$

$$\begin{array}{r|l} 82{\cdot}381 & 143{\cdot}507702\ (1{\cdot}742 \\ & \underline{82381} \\ & 611267 \\ & \underline{576667} \\ & \quad 346000 \\ & \quad \underline{329524} \\ & \quad\quad 164762 \\ & \quad\quad \underline{164762} \end{array}$$

$$\begin{aligned}&143{\cdot}507702 \div (107{\cdot}8 + 6{\cdot}541 - 31{\cdot}96)\\ &= \frac{143507702}{1000000} \div \left(\frac{1078}{10} + \frac{6541}{1000} - \frac{3196}{100}\right).\\ &= \frac{143507702}{1000000} \div \frac{107800 + 6541 - 31960}{1000}\\ &= \frac{143507702}{1000000} \times \frac{1000}{82381}\\ &= \frac{143507702}{82381} \times \frac{1000}{1000000} = \frac{1742}{1000} = 1{\cdot}742.\end{aligned}$$

2. (1)

$$\begin{array}{r|l} 3{\cdot}81 & 3496{\cdot}18000\ (917{\cdot}632 \\ & \underline{3429} \\ & \quad 671 \\ & \quad \underline{381} \\ & \quad 2908 \\ & \quad \underline{2667} \\ & \quad\quad 2410 \\ & \quad\quad \underline{2286} \\ & \quad\quad\quad 1240 \\ & \quad\quad\quad \underline{1143} \\ & \quad\quad\quad\quad 970 \\ & \quad\quad\quad\quad \underline{762} \\ & \quad\quad\quad\quad 208 \end{array}$$

$$\begin{aligned}&3496{\cdot}18 \div 3{\cdot}81\\ &= \frac{349618}{100} \times \frac{100}{381}\\ &= \frac{349618000}{381} \times \frac{1}{1000}\\ &= \frac{917632\ldots}{1000} = 917{\cdot}632\ldots\end{aligned}$$

```
·023965 ) 1·916065200 ( 79·952
          167755
           238515
           215685
            228302
            215685
             126170
             119825
               63450
               47930
               15520
```

$$1·9160652 \div ·023965$$

$$= \frac{19160652}{10000000} \times \frac{1000000}{23965}$$

$$= \frac{1916065200}{23965} \times \frac{1}{1000}$$

$$= \frac{79952...}{1000} = 79·952...$$

```
5307 ) 3495·200 ( ·658
       31842
        31100
        26535
         45650
         42456
          3194
```

$$3495·2 \div 5307$$

$$= \frac{34952}{10} \times \frac{1}{5307}$$

$$= \frac{34952}{5307} \times \frac{1}{10}$$

$$= \frac{3495200}{5307} \times \frac{1}{1000}$$

$$= \frac{658...}{1000} = ·658...$$

(2)

```
3936·2 ) 84·5000 ( ·021
         78724
          57760
          39362
          18398
```

$$84·5 \div 3936·2$$

$$= \frac{845}{10} \times \frac{10}{39362}$$

$$= \frac{845000}{39362} \times \frac{1}{1000}$$

$$= \frac{21...}{1000} = ·021.$$

```
28·713 ) 37·520000 ( 1·306
         28713
          88070
          86139
           193100
           172278
            20822
```

$$37·52 \div 28·713$$

$$= \frac{3752}{100} \times \frac{1000}{28713}$$

$$= \frac{37520000}{28713} \times \frac{1}{1000}$$

$$= \frac{1306...}{1000} = 1·306.$$

2·14) ·00340 (·001
214
116

$$\cdot0034 \div 2\cdot14 = \frac{34}{10000} \times \frac{100}{214}$$
$$= \frac{340}{214} \times \frac{1}{1000}$$
$$= \frac{1\ldots}{1000} = \cdot001\ldots$$

3. No. of days $= 63\cdot25 \div 2\cdot3$;

2·3) 63·25 (27·5
46
172
161
115
115

∴ No. of days $= 27\cdot5 = 27\frac{5}{10} = 27\frac{1}{2}$.

4. 1·3569) ·0498552198 (·036742
40707
91482
81414
100681
94983
56989
54276
27138
27138

the other no. $= \cdot036742$.

5. 1048·69) 354936·00000 (338·456
314607
403290
314607
886830
838952
478780
419476
593040
524345
686950
629214
57736

6. The average age of the remaining children

$$=\frac{10{\cdot}515\times50-(13{\cdot}5\times2+12{\cdot}375\times8+11\times17)}{23}\text{ yrs.}$$

$$=\frac{525{\cdot}75-313}{23}\text{ yrs.}$$

$$=\frac{212{\cdot}75}{23}\text{ yrs.}=9{\cdot}25\text{ yrs.}=9\tfrac{1}{4}\text{ yrs.}$$

7. No. of children who attended on

Monday = 67 + 64
Tuesday = 60 + 59
Wednesday = 65 + 59
Thursday = 68 + 63
Friday = 62 + 60

∴ the total no. of children who attended on these 10 occasions = 627;

$$\therefore\ \text{average attendance}=\frac{627}{10}=62{\cdot}7.$$

VULGAR FRACTIONS EXPRESSED AS DECIMALS.

Ex. XXIV. Page 68.

(1)
$$\begin{array}{r|l} 4 & 3{\cdot}00 \\ \hline & \cdot75 \end{array}\qquad \begin{array}{r|l} 2 & 1{\cdot}0 \\ \hline & \cdot5 \end{array}\qquad \begin{array}{r|l} 4 & 5{\cdot}00 \\ \hline & 1{\cdot}25 \end{array}\qquad \begin{array}{r|l} 5 & 3{\cdot}0 \\ \hline & \cdot6 \end{array}$$

$$\therefore\ 2\tfrac{3}{5}=2{\cdot}6;$$

$$16\begin{cases}4\\4\end{cases}\begin{array}{|r} 7{\cdot}00 \\ \hline 1{\cdot}7500 \\ \hline \cdot4375 \end{array}\qquad \frac{11}{20}=\frac{55}{100}=\cdot55;\quad 7\tfrac{19}{25}=7\tfrac{76}{100}=7{\cdot}76.$$

$$40\begin{cases}4\\10\end{cases}\begin{array}{|r} 13{\cdot}00 \\ \hline 3{\cdot}250 \\ \hline \cdot325 \end{array}\qquad\qquad 32\begin{cases}4\\8\end{cases}\begin{array}{|r} 7{\cdot}00 \\ \hline 1{\cdot}75000 \\ \hline \cdot21875 \end{array}$$

$$\therefore\ 8\tfrac{7}{32}=8{\cdot}21875.$$

(2) $$128\left\{\begin{array}{c|l} 4 & 37 \\ \hline 8 & 9{\cdot}25000 \\ \hline 4 & 1{\cdot}1562500 \\ \hline & {\cdot}2890625 \end{array}\right. \qquad \therefore\ 17\tfrac{37}{128}=17{\cdot}2890625;$$

$$\frac{4}{125}=\frac{32}{1000}={\cdot}032;$$

$$\frac{570}{400}=\frac{57}{40}; \qquad 40\left\{\begin{array}{c|l} 4 & 57 \\ \hline 10 & 14{\cdot}25 \\ \hline & 1{\cdot}425 \end{array}\right.$$

$$1024\left\{\begin{array}{c|l} 8 & 5{\cdot}000 \\ \hline 8 & {\cdot}625000 \\ \hline 8 & {\cdot}078125000 \\ \hline 2 & {\cdot}0097656250 \\ \hline & {\cdot}0048828125 \end{array}\right.$$

$$\therefore\ 100\tfrac{5}{1024}=100{\cdot}0048828125;$$

$$\frac{729}{12150}=\frac{3}{50}=\frac{6}{100}={\cdot}06;$$

$$\frac{241}{15424}=\frac{1}{64},$$

$$64\left\{\begin{array}{c|l} 8 & 1{\cdot}000 \\ \hline 8 & {\cdot}125 \\ \hline & {\cdot}015625 \end{array}\right. \qquad \therefore\ 23\tfrac{241}{15424}=23{\cdot}015625.$$

(3) $$\frac{2}{5}+\frac{5}{8}+\frac{1}{16}-1\tfrac{1}{40}={\cdot}4+{\cdot}625+{\cdot}0625-1{\cdot}025$$
$$=1{\cdot}0875-1{\cdot}025={\cdot}0625;$$

$$1\tfrac{3}{4}-\frac{7}{8}\text{ of }\frac{18}{28}=1\tfrac{3}{4}-\frac{9}{16}=1{\cdot}75-{\cdot}5625=1{\cdot}1875;$$

$$\frac{5}{6}\text{ of }\frac{12}{25}+5\tfrac{1}{2}=\frac{2}{5}+5\tfrac{1}{2}={\cdot}4+5{\cdot}5=5{\cdot}9.$$

(4) $3\frac{3}{4}$ of $2\frac{1}{2} = 3{\cdot}75$ of $2{\cdot}5 = 9{\cdot}375$;

$5\frac{1}{2}$ of $5\frac{1}{4}$ of $5\frac{1}{8} = 5{\cdot}5 \times 5{\cdot}25 \times 5{\cdot}125 = 147{\cdot}984375$;

$$7\frac{37}{1600} \text{ of } 15\frac{9}{200} = 7\frac{{\cdot}37}{16} \text{ of } 15\frac{45}{1000} = 7\frac{{\cdot}0925}{4} \text{ of } 15{\cdot}045$$

$$= 7{\cdot}023125 \times 15{\cdot}045$$

$$= 105{\cdot}662915625.$$

(5) $3\frac{7}{8} - 2\frac{1}{5} + 4\frac{9}{20} = 3{\cdot}875 - 2{\cdot}2 + 4{\cdot}45$

$$= 8{\cdot}325 - 2{\cdot}2 = 6{\cdot}125;$$

$$15\frac{19}{640} + \frac{3}{{\cdot}075} \text{ of } \frac{7}{5} \text{ of } 2\frac{1}{2} = 15\frac{2{\cdot}375}{80} + \frac{3000}{75} \text{ of } \frac{7}{5} \text{ of } \frac{5}{2}$$

$$= 15{\cdot}0296875 + 140$$

$$= 155{\cdot}0296875.$$

CIRCULATING DECIMALS.

Ex. XXV. Page 71.

1. (1)

$$\begin{array}{r|l} 3 & 2{\cdot}00 \\ \hline & \;{\cdot}66\ldots \end{array} \qquad \begin{array}{r|l} 9 & 1{\cdot}00 \\ \hline & \;{\cdot}11\ldots \end{array}$$

$$= {\cdot}\dot{6}; \qquad = {\cdot}\dot{1};$$

$$\begin{array}{r|l} 7 & 6{\cdot}0000000 \\ \hline & \;{\cdot}8571428\ldots \end{array} \qquad \begin{array}{r|l} 12 & 7{\cdot}00000 \\ \hline & \;{\cdot}58333\ldots \end{array}$$

$$= {\cdot}\dot{8}5714\dot{2}; \qquad = {\cdot}58\dot{3};$$

$$15\left\{\begin{array}{r|l} 5 & 11{\cdot}0 \\ \hline 3 & \;2{\cdot}2000 \\ \hline & \;\;{\cdot}7333\ldots \end{array}\right. \qquad 99\left\{\begin{array}{r|l} 9 & 4{\cdot}000 \\ \hline 11 & \;{\cdot}444\ldots \\ \hline & \;{\cdot}0404\ldots \end{array}\right.$$

$$= {\cdot}7\dot{3}; \qquad = {\cdot}\dot{0}\dot{4};$$

$$\begin{array}{r|l} 13 & \underline{3\cdot000000} \\ & \;\cdot2307692\ldots \end{array}$$

$$= \cdot\dot{2}3076\dot{9}.$$

(2)

$$81\begin{cases}9\\9\end{cases}\begin{array}{|l} \underline{3\cdot0\quad} \\ \underline{\;\cdot3333\ldots} \\ \;\cdot0370\ldots \end{array} \qquad \therefore\ 6\tfrac{3}{81} = 6\cdot\dot{0}3\dot{7};$$

$$\begin{array}{r} 37\,)\,5\cdot0\,(135 \\ \underline{37} \\ 130 \\ \underline{111} \\ 190 \\ \underline{185} \\ 5 \end{array} \qquad \therefore\ 7\tfrac{5}{37} = 7\cdot\dot{1}3\dot{5};$$

$$9009\begin{cases}9 \\ 1001\end{cases}\begin{array}{l} |\,\underline{4\cdot0\ldots} \\ )\;\cdot44444\ldots\;(\cdot000444 \\ \quad\underline{4004} \\ \quad\;\;4404 \\ \quad\;\;\underline{4004} \\ \quad\;\;\;\;4004 \\ \quad\;\;\;\;\underline{4004} \\ \quad\;\;\;\;\;\;\;\;\;4 \end{array}$$

$$\therefore\ \frac{4}{9009} = \cdot\dot{0}0044\dot{4};$$

$$44\begin{cases}4\\11\end{cases}\begin{array}{|l} \underline{7\cdot0} \\ \underline{1\cdot75\qquad} \\ \cdot159090\ldots \end{array} \qquad \therefore\ 100\tfrac{7}{44} = 100\cdot15\dot{9}\dot{0};$$

$$\begin{array}{l}
17\,\big)\,15\cdot0\,\big(\,\cdot\dot{8}82352941176470\dot{5}\\
\quad\;\;\underline{136}\\
\quad\;\;\;140\\
\quad\;\;\;\underline{136}\\
\quad\;\;\;\;\;40\\
\quad\;\;\;\;\;\underline{34}\\
\quad\;\;\;\;\;\;\;60\\
\quad\;\;\;\;\;\;\;\underline{51}\\
\quad\;\;\;\;\;\;\;\;\;90\\
\quad\;\;\;\;\;\;\;\;\;\underline{85}\\
\quad\;\;\;\;\;\;\;\;\;\;\;50\\
\quad\;\;\;\;\;\;\;\;\;\;\;\underline{34}\\
\quad\;\;\;\;\;\;\;\;\;\;\;160\\
\quad\;\;\;\;\;\;\;\;\;\;\;\underline{153}\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;70\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\underline{68}\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;20\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\underline{17}\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;30\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\underline{17}\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;130\\
\quad\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\underline{119}\\
\quad\;110\\
\quad\;\underline{102}\\
\quad\;80\\
\quad\;\underline{68}\\
\quad\;120\\
\quad\;\underline{119}\\
\quad\;100\\
\quad\;\underline{86}\\
\quad\;15
\end{array}$$

$$\therefore\; 2\tfrac{15}{17} = 2\cdot\dot{8}82352941176470\dot{5}.$$

2. (1) $\cdot\dot{2} = \dfrac{2}{9}$; $\cdot\dot{0}\dot{5} = \dfrac{5}{99}$; $\cdot\dot{1}\dot{8} = \dfrac{18}{99} = \dfrac{2}{11}$;

$$\cdot1\dot{5}\dot{6} = \frac{156-1}{990} = \frac{155}{990} = \frac{31}{198};$$

$$\cdot027\dot{0}2\dot{7} = \frac{27}{999} = \frac{3}{111} = \frac{1}{37};$$

$$\cdot\dot{2}8571\dot{4}=\frac{285714}{999999}=\frac{142857\times2}{142857\times7}=\frac{2}{7}.$$

(2) $\cdot5\dot{6}6=\frac{56-5}{90}=\frac{51}{90}=\frac{17}{30}$;

$$\cdot7\dot{4}\dot{3}=\frac{743-7}{990}=\frac{736}{990}=\frac{368}{495};$$

$$\cdot2\dot{0}23\dot{5}=\frac{20235-2}{99990}=\frac{20233}{99990};$$

$$19\cdot30\dot{5}=19\frac{305-30}{900}=19\frac{275}{900}=19\frac{11}{36};$$

$$20\cdot0291\dot{6}=20\frac{2916-291}{90000}=20\frac{2625}{90000}=20\frac{375\times7}{375\times240}=20\frac{7}{240}.$$

3. (1)

4·33333333
16·45454546
293·90909090
75·73523523

390·43220492

Ans. 390·432204.

(2)

3·23333333
26·79679680
503·81281281
7·41341341

541·25635635

Ans. 541·256356.

(3)

3·85646464
2·03877778

1·81768686

Ans. 1·817686.

(4)

52·86868687
8·37235723

44·49632964

Ans. 44·496329.

4. (1) $7\cdot\dot{6}\times5\cdot\dot{3}=7\tfrac{2}{3}\times5\tfrac{1}{3}=\frac{23}{3}\times\frac{16}{3}=\frac{368}{9}=40\cdot88=40\cdot\dot{8}$;

$$\cdot\dot{3}5\dot{1}\times\cdot7\dot{3}\dot{6}=\frac{351}{999}\times\frac{736-7}{990}=\frac{13}{37}\times\frac{729}{990}=\frac{13}{37}\times\frac{81}{110}$$
$$=\frac{1053}{4070}=\cdot258\ldots;$$

$$\cdot1\dot{3}\times\cdot2\times\cdot\dot{4}=\frac{13-1}{90}\times\frac{2}{10}\times\frac{4}{9}=\frac{6}{45}\times\frac{1}{5}\times\frac{4}{9}=\frac{8}{15\times5\times9}$$
$$=\frac{8}{5\times5\times3\times3\times3};$$

$$\begin{array}{r|l}
5 & 8 \\ \hline
5 & 1{\cdot}6 \\ \hline
3 & {\cdot}32 \\ \hline
3 & {\cdot}10666 \\ \hline
3 & {\cdot}0355555 \\ \hline
 & {\cdot}0118518\ldots
\end{array}$$

$$\therefore\ 1\dot{3} \times {\cdot}\dot{2} \times {\cdot}\dot{4} = {\cdot}01\dot{1}8\dot{5}.$$

(2) $6{\cdot}\dot{7} \div 2{\cdot}\dot{6} = 6\tfrac{7}{9} \div 2\tfrac{2}{3} = \dfrac{61}{9} \times \dfrac{3}{8} = \dfrac{61}{3 \times 8};$

$$\begin{array}{r|l}
3 & 61 \\ \hline
8 & 20{\cdot}3333 \\ \hline
 & 2{\cdot}541\dot{6}
\end{array}$$

$$\therefore\ \text{Ans.} = 2{\cdot}541\dot{6}.$$

$$\begin{aligned}
{\cdot}26\dot{2}\dot{7} \div 1{\cdot}92\dot{6} &= \frac{2627-26}{9900} \div 1\frac{926-92}{900} \\
&= \frac{2601}{9900} \div 1\frac{834}{900} \\
&= \frac{289}{1100} \times \frac{900}{1734} = \frac{2601}{11 \times 1734} = \frac{867}{11 \times 578} \\
&= \frac{78{\cdot}818181\ldots}{578} = {\cdot}1\dot{3}\dot{6};
\end{aligned}$$

$${\cdot}3\dot{7}\dot{1} \div 5 = \frac{371-3}{990} \times \frac{1}{5} = \frac{368}{990 \times 5} = \frac{73{\cdot}6}{990} = \frac{7{\cdot}36}{99} = {\cdot}07\dot{4}\dot{3};$$

$$\begin{aligned}
42{\cdot}0463 \div 1{\cdot}\dot{3}\dot{6} &= 42{\cdot}0463 \div 1\tfrac{36}{99} = \frac{42{\cdot}0463 \times 11}{15} \\
&= \frac{462{\cdot}5093}{15} = \frac{92{\cdot}50186}{3} = 30{\cdot}83395\dot{3}.
\end{aligned}$$

REDUCTION OF DECIMALS.—Ex. XXVI. Page 74.

1. (1)

£
·25
20
5·00*s.*
Ans. 5*s.*

£
·025
20
·500*s.*
12
6·000*d.*
Ans. 6*d.*

£
·675
20
13·500*s.*
12
6·000*d.*
Ans. 13*s.* 6*d.*

£
·39375
20
7·87500*s.*
12
10·50000*d.*
4
2·00000*q.*
Ans. 7*s.* $10\frac{1}{2}$*d.*

(2)

£
·365625
20
7·312500*s.*
12
3·750000*d.*
4
3·000000*q.*
Ans. 7*s.* $3\frac{3}{4}$*d.*

£
·003125
20
·062500*s.*
12
·750000*d.*
4
3·000000*q.*
Ans. $\frac{3}{4}$*d.*

£
·8756
20
17·5120*s.*
12
6·1440*d.*
Ans. 17*s.* $6\frac{144}{1000}$*d.*
$=$17*s.* $6\frac{18}{125}$*d.*

(3)

£
7·75
20
15·00*s.*
Ans. £7. 15*s.*

·325 of £5
5
£1·625
20
12·500*s.*
12
6·000*d.*
Ans. £1. 12*s.* 6*d.*

£
3·240625
20
4·812500*s.*
12
9·750000*d.*
4
3·000000*q.*
Ans. £3. 4*s.* $9\frac{3}{4}$*d.*

(4)

guineas
·375
21
375
750
7·875*s.*
12
10·500*d.*
4
2·000*q.*
Ans. 7*s.* $10\frac{1}{2}$*d.*

guineas
2·46875
21
46875
93750
9·84375*s.*
12
10·12500*d.*
Ans. 2gs. 9*s.* $10\frac{125}{1000}$*d.*
or £2. 11*s.* $10\frac{1}{8}$*d.*

1·37 of 5*s.*
5
6·85*s.*
12
10·20*d.*
Ans. 6*s.* $10\frac{1}{5}$*d.*

(5) lb. Troy
·765625
12
9·187500 oz.
20
3·750000 dwts.
24
3000000
1500000
18·000000 grs.

Ans. 9 oz. 3 dwts. 18 grs.

ac.
·875
4
3·500 ro.
40
20·000 po.

Ans. 3 ro. 20 po.

mi.
·90625
8
7·25000 fur.
40
10·00000 po.

Ans. 7 fur. 10 po.

(6) tons
5·01875
20
·37500 cwt.
4
1·50000 qr.
28
14·0 lbs.

Ans. 5 tons 1 qr. 14 lbs.

·815 of 15*s*. 6*d*.
31
815
2445
25·265 sixpences
6
1·590*d*.
4
2·360*q*.

Ans. 12*s*. 7$\frac{1}{2}$*d*. $\frac{9}{25}$*q*.

·007875 of £1000
1000
£7·875
20
17·500*s*.
12
6·0*d*.

Ans. £7. 17*s*. 6*d*.

(7)
ac.
2·35078125
4
1·40312500 ro.
40
16·125000 po.
$30\frac{1}{4}$
8750
3125
3·78125 yds.
9
7·03125 ft.
144
12500
12500
3125
4·50000 in.

Ans. = 2 ac. 1 ro. 16 po. 3 yds. 7 ft. $4\frac{1}{2}$ in.

7·243 days
24
972
486
5·832 hrs.
60
49·920 min.
60
55·200 sec.
Ans. 7d. 5 hrs. 49 min. $55\frac{1}{5}$ sec.

1·43625 of £2. 10*s.*
50
71·81250*s.*
12
9·7500*d.*
4
3·00*q.*

Ans. = £3. 11*s.* $9\frac{3}{4}$*d.*

(8) 2 lbs. 7 oz. 15 dwts. = 635 dwts.

2·315
635
11575
6945
13890
1470·025

Ans. = $1470\frac{1}{40}$ dwts.
= 6 lbs. 1 oz. $10\frac{1}{40}$ dwts.

lea.
3·05
3
9·15 mi.
8
1·20 fur.
40
8·00 po.

Ans. = 9 mi. 1 fur. 8 po.

qrs.
11·732
28
5856
1464
20·496 lbs.
16
2976
496
7·936 oz.

Ans. = 2 cwt. 3 qrs. 20 lbs. $7\frac{117}{125}$ oz.

(9) ells
7·875
5
4·375 qrs.
4
1·500 nls.

Ans. = 7 ells 4 qrs. $1\frac{1}{2}$ nls.

£1. 11*s*. 3*d*. = 375*d*.
1·605
375
8025
11235
4815
601·875 *d*.
4
3·500 *q*.

Ans. = £2. 10*s*. $1\frac{3}{4}$*d*. $\frac{1}{2}$*q*.

sq. mi.
3·23571
640
942840
141426
150·85440 ac.
4
3·4176 ro.
40
16·7040 po.
$30\frac{1}{4}$
21120
176
21·296 yds.
9
2·664 ft.
144
2656
2656
664
95·616 in.

Ans. = 3 sq. mi. 150 ac. 3 ro. 16 po. 21 yds. 2 ft. $95\frac{77}{125}$ in.

(10) 17 lbs. 2 oz. 2 scr. = 4946 scr.

$$\begin{array}{r} \text{scr.}\\ 4946\\ 2{\cdot}15\\ \hline 24730\\ 4946\\ 9892\\ \hline 10633{\cdot}90 \text{ scr.}\\ 20\phantom{\text{ scr.}}\\ \hline 18{\cdot}0 \text{ grs.} \end{array}$$

Ans. = 10633 scr. 18 grs.
= 36 lbs. 11 oz. 1 scr. 18 grs.

6 hhds. 1 bar. = 10 bar.

$$\begin{array}{r} 31{\cdot}25\\ 10\\ \hline 312{\cdot}5 \text{ bar.}\\ 36\phantom{\text{ bar.}}\\ \hline 18{\cdot}0 \text{ gal.} \end{array}$$

Ans. = 208 hhds. 18 gal.

2. (1) $\cdot\dot{3}$ of £1 $= \frac{1}{3}$ of £1 $= \frac{20s.}{3} = 6s.\ 8d.$;

$\cdot\dot{6}$ of a guinea $= \left(\frac{6}{9} \text{ of } 21\right)s. = 14s.$;

$$\cdot 2\dot{6} \text{ of £}1 = \frac{26-2}{90} \text{ of £}1 = \frac{24}{90} \text{ of £}1 = \left(\frac{12}{45} \text{ of } 20\right)s.$$

$$= \frac{16}{3}s. = 5s.\ 4d.$$

(2) $$\cdot 13541\dot{6} \text{ of £}1 = \left(\frac{135416-13541}{900000} \text{ of } 20\right)s.$$

$$= \left(\frac{121875}{900000} \text{ of } 20\right)s. = \left(\frac{13}{96} \text{ of } 20\right)s.$$

$$= 2s.\ 8\tfrac{1}{2}d.;$$

$$3{\cdot}4097\dot{2} \text{ of £}1.\ 4s. = \left(3\frac{40972-4097}{90000} \text{ of } 24\right)s.$$

$$= \left(3\frac{36875}{90000} \text{ of } 24\right)s. = \left(3\frac{59}{144} \text{ of } 24\right)s$$

$$= \frac{491}{6}s. = 81s.\ 10d. = \text{£}4.\ 1s.\ 10d.;$$

$$2{\cdot}0\dot{2}\dot{7} \text{ of } 4s.\ 7d. = (2\tfrac{27}{990} \text{ of } 55)d. = (2\tfrac{3}{110} \text{ of } 55)d.$$

$$= \frac{223}{2}d. = 111\tfrac{1}{2}d. = 9s.\ 8\tfrac{1}{2}d.$$

(3) $$\cdot62\dot{8} \text{ of } 7\tfrac{1}{2} \text{ guineas} = \left(\frac{628-62}{900} \text{ of } \frac{15}{2}\right) \text{ guineas}$$

$$= \left(\frac{283}{450} \text{ of } \frac{15}{2}\right) \text{ guineas} = \left(\frac{283}{60}\right) \text{ guineas}$$

$$= \left(\frac{283 \times 21}{60}\right) \textit{s.} = £4.\ 19\textit{s.}\ 0\tfrac{1}{2}\textit{d.}\ \tfrac{2}{5}\textit{q.};$$

$$13\cdot2\dot{7}\dot{5} \text{ of } 2 \text{ ac. } 3 \text{ ro.} = \left(13\frac{275-2}{990} \text{ of } 2\tfrac{3}{4}\right) \text{ ac.}$$

$$= \left(13\frac{273}{990} \text{ of } \frac{11}{4}\right) \text{ ac.} = \left(13\frac{91}{330} \text{ of } \frac{11}{4}\right) \text{ ac.}$$

$$= \left(\frac{4381}{330} \times \frac{11}{4}\right) \text{ ac.} = \frac{4381}{120} \text{ ac.}$$

$$= 36 \text{ ac. } 2 \text{ ro. } 1 \text{ po. } 10 \text{ yds. } 108 \text{ in.};$$

$$1\cdot1\dot{4}\dot{5} \text{ of } \cdot168\dot{3} \text{ lbs.} = \left(1\frac{145-1}{990} \text{ of } \frac{1683-168}{9000}\right) \text{ lbs.}$$

$$= \left(1\frac{144}{990} \text{ of } \frac{1515}{9000} \text{ of } 16\right) \text{ oz.}$$

$$= \left(1\frac{8}{55} \text{ of } \frac{101}{600} \text{ of } 16\right) \text{ oz.}$$

$$= \left(\frac{63}{55} \text{ of } \frac{101}{75} \text{ of } 2\right) \text{ oz.}$$

$$= \left(\frac{21 \times 101 \times 2}{55 \times 25}\right) \text{ oz.} = 3\frac{117}{1375} \text{ oz.}$$

(4) $$\cdot726\dot{8}5\dot{1} \text{ of } 27\textit{s.} = \left(\frac{726851-726}{999000} \text{ of } 27\right)\textit{s.}$$

$$= \left(\frac{726125}{999000} \text{ of } 27\right)\textit{s.}$$

$$= \left(\frac{5809}{7992} \text{ of } 27\right)\textit{s.} = \frac{5809}{296}\textit{s.} = 19\textit{s.}\ 7\tfrac{1}{2}\textit{d.};$$

$$\cdot 3\dot{4}0\dot{5} \text{ of } 1 \text{ qr. } 17 \text{ lbs.} = \left(\frac{3405-3}{9990} \text{ of } 45\right) \text{lbs.}$$

$$= \frac{567}{37} \text{ lbs.} = 15 \text{ lbs. } 5\tfrac{7}{37} \text{ oz.};$$

$$\cdot 06\dot{3} \text{ of } 16 \text{ d. } 12 \text{ hrs.} = \left(\frac{63-6}{900} \text{ of } 16\tfrac{1}{2}\right) \text{d.}$$

$$= \left(\frac{57}{900} \text{ of } \frac{33}{2}\right) \text{d.} = 1 \text{ d. } 1 \text{ h. } 4 \text{ m. } 48 \text{ sec.}$$

3. ·725 qr. + ·275 bus. = (·725 × 8 + ·275) bus. = 6·075 lbs.;
∴ value = (80 × 6·075)*d.* = 486*d.* = £2. 0*s.* 6*d.*
1·275 yd. + 3·75 ft. = (1·275 × 3 + 3·75) ft. = 7·575 ft.;
∴ value = (40 × 7·575)*d.* = 303*d.* = £1. 5*s.* 3*d.*

4. $\frac{3}{8}$ cwt. = ·375 cwt., and 4·16525 tons = 83·30500 cwt.;

∴ 4·16525 tons − $\frac{3}{8}$ cwt. = (83·305 − ·375) cwt.
= 82·93 cwt.
= 4 tons, 2 cwt. 3 qrs. 20 lbs. $2\frac{14}{25}$ oz.

2·0396 of 1 mi. 530 yds. − ·867 of ½ mi.
= (2·0396 of 2290 − ·867 of 880) yds.
= (4670·684 − 762·96) yds.
= 3907·724 yds.
= 3907 yds. 2 ft. 2·064 in.

5. (1)

	crowns	guineas
2·25	3·1875	·375
3·5	5	21
1125	15·9375*s.*	375
675	12	750
7·875*s.*	11·2500*d.*	7·875*s.*
12	4	12
10·500*d.*	1·0000*q.*	10·500*d.*
4		4
2·000*q.*		2·000*q.*

∴ value = 7*s.* 10½*d.* + 15*s.* 11¼*d.* − 7*s.* 10½*d.*
= £1. 3*s.* 9¾*d.* − 7*s.* 10½*d.* = 15*s.* 11¼*d.*

$$\begin{array}{r}
4{\cdot}275 \\
20 \\ \hline
85{\cdot}500\pounds \\
20 \\ \hline
10{\cdot}0s.
\end{array}
\qquad\qquad
\begin{array}{rl}
2{\cdot}625 & \\
10{\cdot}8 & \\ \hline
21000 & \\
2625 & \\ \hline
28{\cdot}3500 & \text{guineas} \\
21 & \\ \hline
35 & \\
70 & \\ \hline
7{\cdot}35s. & \\
12 & \\ \hline
4{\cdot}20d. &
\end{array}$$

$$\begin{array}{r}
5{\cdot}375 \\
{\cdot}375 \\ \hline
26875 \\
37625 \\
16125 \\ \hline
2{\cdot}015625\pounds \\
20 \\ \hline
{\cdot}312500s. \\
12 \\ \hline
3{\cdot}7500d.
\end{array}$$

∴ value $=\pounds85.\ 10s. - \pounds29.\ 15s.\ 4\frac{1}{5}d. + \pounds2.\ 0s.\ 3\frac{3}{4}d.$

$=\pounds87.\ 10s.\ 3\frac{3}{4}d. - \pounds29.\ 15s.\ 4\frac{1}{5}d.$

$=\pounds57.\ 14s.\ 11\frac{11}{20}d. = \pounds57.\ 14s.\ 11\frac{1}{2}d.\ \frac{1}{5}q.$

(3)

$$\begin{array}{rl}
3{\cdot}325 & \\
1{\cdot}5 & \\ \hline
16625 & \\
3325 & \\ \hline
4{\cdot}9875 & \text{tons} \\
20 & \\ \hline
19{\cdot}7500 & \text{cwt.} \\
4 & \\ \hline
3{\cdot}00 & \text{qrs.}
\end{array}$$

$$4{\cdot}20\dot{6} \text{ of } 3 \text{ cwt. } 3 \text{ qrs.} = \left(4\frac{206-20}{900} \text{ of } 3\tfrac{3}{4}\right) \text{cwt.}$$

$$= \frac{631}{40} \text{cwt.}$$

$$= 15 \text{ cwt. } 3\tfrac{1}{10} \text{ qr.}$$

$$2{\cdot}25 \text{ of } {\cdot}001 \text{ of } 100{\cdot}\dot{5} \text{ tons} = \left(2\tfrac{1}{4} \text{ of } \frac{1}{1000} \text{ of } 100\tfrac{5}{9}\right) \text{ tons}$$
$$= \frac{181}{40} \text{ cwt.} = 4 \text{ cwt. } 2\tfrac{1}{10} \text{ qrs.};$$

$\therefore$ value $= 4$ tons, 19 cwt. 3 qrs. $-$ 15 cwt. $3\frac{1}{10}$ qrs.
$+$ 4 cwt. $2\frac{1}{10}$ qrs.
$= 5$ tons, 4 cwt. $1\frac{1}{10}$ qr. $-$ 15 cwt. $3\frac{1}{10}$ qr.
$= 4$ tons, 8 cwt. 2 qrs.

Ex. XXVII. Page 77.

1. (1)

$$\begin{array}{r|l} 12 & 6{\cdot}0 \\ \hline 2,0 & 2{\cdot}50,0 \\ \hline & {\cdot}125 \end{array} \qquad \begin{array}{r|l} 12 & 4{\cdot} \\ \hline 2,0 & 5{\cdot}3333\ldots \\ \hline & {\cdot}2666\ldots \end{array}$$

$$\begin{array}{r|l} 12 & 3{\cdot} \\ \hline 2,0 & 7{\cdot}25 \\ \hline & {\cdot}3625 \end{array} \qquad \begin{array}{r|l} 12 & 8{\cdot} \\ \hline 2,0 & 16{\cdot}666\ldots \\ \hline & {\cdot}8333\ldots \end{array}$$

(2)

$$\begin{array}{r|l} 4 & 1{\cdot} \\ \hline 12 & 10{\cdot}25 \\ \hline 2,0 & 3{\cdot}854166\ldots \\ \hline & {\cdot}19270833\ldots \end{array} \qquad \begin{array}{r|l} 4 & 3{\cdot} \\ \hline 12 & 9{\cdot}75 \\ \hline 2,0 & 4{\cdot}8125 \\ \hline & {\cdot}240625 \end{array}$$

$$\begin{array}{r|l} 12 & 4{\cdot} \\ \hline 2,0 & {\cdot}3333\ldots \\ \hline & {\cdot}0166\ldots \end{array} \qquad \begin{array}{r|l} 4 & 2{\cdot} \\ \hline 12 & 0{\cdot}5 \\ \hline 2,0 & 7{\cdot}04166\ldots \\ \hline & {\cdot}3520833\ldots \end{array}$$

(3)

$$\begin{array}{r|l} 4 & 3{\cdot} \\ \hline 12 & 6{\cdot}75 \\ \hline 21\left\{\begin{array}{l}3\\7\end{array}\right. & \begin{array}{l}6{\cdot}5625\\ \hline 2{\cdot}1875\end{array} \\ \hline & {\cdot}3125 \end{array}$$

5*s.* 6*d.* = 66*d.*; 13*s.* 4*d.* = 160*d.*;

$\therefore$ 5*s.* 6*d.* $= \frac{33}{80}$ of 13*s.* 4*d.*

$$\begin{array}{r|l} 80\left\{\begin{array}{r}8\\10\end{array}\right. & \begin{array}{l}33{\cdot}\\ \hline 4{\cdot}125\end{array} \\ \hline & {\cdot}4125 \end{array}$$

Again, 5*s*. 6*d*. $=\frac{11}{21}$ of 10*s*. 6*d*.

$$21\begin{cases}3\\7\end{cases}\begin{array}{|l}11\cdot\\ \hline 3\cdot666\ldots\\ \hline \cdot5238095\ldots\end{array}\qquad\qquad \begin{array}{r|l}12 & 6\cdot\\ \hline 10 & 5\cdot5\\ \hline & \cdot55\end{array}$$

(4) 6½*d*. $=\frac{13}{60}$ of half-a-crown;

$$60\begin{cases}6\\10\end{cases}\begin{array}{|l}13\\ \hline 2\cdot1666\ldots\\ \hline \cdot2166\ldots\end{array}$$

7½ guineas = £7. 17*s*. 6*d*.

$$\begin{array}{r|l}12 & 6\cdot\\ \hline 2{,}0 & 17\cdot5\\ \hline 1000 & 7\cdot875\\ \hline & \cdot007875\end{array}$$

14*s*. 9¾*d*. = 29 sixpences 3¾*d*.

$$\begin{array}{r|l}4 & 3\cdot\\ \hline 6 & 3\cdot75\\ \hline 21\begin{cases}3\\7\end{cases} & \begin{array}{l}29\cdot625\\ \hline 9\cdot875\end{array}\\ \hline & 1\cdot4107142857\ldots\end{array}$$

(5)

$$\begin{array}{r|l}4 & 3\cdot\\ \hline 12 & 9\cdot75\\ \hline 2{,}0 & 11\cdot8125\\ \hline & \cdot590625\end{array}\qquad,\qquad \begin{array}{r|l}4 & 3\cdot\\ \hline 12 & 9\cdot75\\ \hline 3{,}0 & 51\cdot8125\\ \hline & 1\cdot7270833\ldots\end{array}$$

Ans. = 2·590625.

£2. 11*s*. 9¾*d*. = 103 sixpences 3¾*d*.

$$\begin{array}{r|l}4 & 3\cdot\\ \hline 6 & 3\cdot75\\ \hline 21\begin{cases}3\\7\end{cases} & \begin{array}{l}103\cdot625\\ \hline 34\cdot5416\dot{6}\end{array}\\ \hline & 4\cdot93452380952\ldots\end{array}$$

5¾ guineas = £5. 5*s*. + 15*s*. 9*d*. = £6. 0*s*. 9*d*.

$$\begin{array}{r|l} 12 & 9\cdot \\ 100 & 120\cdot 75 \\ & 1\cdot 2075 \end{array}$$

(6)

$$\begin{array}{r|l} 4,0 & 26\cdot \\ 8 & 1\cdot 65 \\ & \cdot 20625 \end{array} \qquad \begin{array}{r|l} 24\begin{cases}6 \\ 4\end{cases} & \begin{array}{l}12\cdot \\ 2\cdot\end{array} \\ 2,0 & 14\cdot 5 \\ 12 & \cdot 725 \\ & \cdot 0604166\ldots \end{array}$$

$$\begin{array}{r|l} 12 & 7\cdot 5 \\ 3 & 2\cdot 625 \\ 1760\begin{cases}4 \\ 4 \\ 11 \\ 10\end{cases} & \begin{array}{l}6\cdot 875 \\ 1\cdot 71875 \\ \cdot 4296875 \\ \cdot 0390625\end{array} \\ & \cdot 00390625 \end{array}$$

(7)

$$\begin{array}{r|l} 3 & 2\cdot 5 \\ & 4\cdot 833 \\ & \quad\;\; 2 \\ 11 & 9\cdot 666 \\ 40 & 5\cdot 878787 \\ & \cdot 146969\ldots \end{array}$$

$$\begin{array}{r|l} 6,0 & 30\cdot \\ 6,0 & 15\cdot 5 \\ 24\begin{cases}3 \\ 8\end{cases} & \begin{array}{l}\cdot 25833\ldots \\ \cdot 0861111\ldots\end{array} \\ 365\begin{cases}5 \\ 73\end{cases} & \begin{array}{l}\cdot 010763888\ldots \\ )\,\cdot 002152777\ldots\,(\cdot 00002949\ldots\end{array} \end{array}$$

$$\begin{array}{r} 146 \\ \hline 692 \\ 657 \\ \hline 357 \\ 292 \\ \hline 657 \\ 657 \\ \hline \end{array}$$

Ans. (1) ·25833... Ans. (2) ·00002949...

(8)

$$\begin{array}{rr|l} & 8 & 1\cdot \\ \cline{3-3} 63\{ & 9 & 19\cdot125 \\ \cline{3-3} & 7 & 2\cdot125 \\ \cline{3-3} & 2 & \cdot30357\ldots \\ \cline{3-3} & & \cdot151785\ldots \end{array} \qquad \begin{array}{r|l} 9 & 7 \\ \hline 6 & 2\cdot77777\ldots \\ \hline & \cdot46296\ldots \end{array}$$

(9)

$$\begin{array}{rr|r} & 9 & 7\cdot2 \\ \cline{3-3} & & 27\cdot8 \\ & & 4 \\ \cline{3-3} 121\{ & 11 & 111\cdot2 \\ \cline{3-3} & 11 & 10\cdot1090909\ldots \\ \cline{3-3} & 4{,}0 & \cdot9190082\ldots \\ \cline{3-3} & 4 & \cdot02297520\ldots \\ \cline{3-3} & & \cdot005743\ldots \end{array} \qquad \begin{array}{r|l} 4 & 2\cdot75 \\ \hline 8 & 5\cdot6875 \\ \hline 5 & \cdot7109375 \\ \hline & \cdot1421875 \end{array}$$

(10) $\frac{2}{3}$ of a crown $= £\frac{2}{12} = £\frac{1}{6} = \cdot166\ldots$ of £1;

$\frac{5}{7}$ of half a crown $= £\frac{5}{7 \times 8} = £\frac{\cdot625}{7}$

$= \cdot0892857142\ldots$ of £1;

$1\frac{17}{20}$ of 3*s.* 4*d.* $= £\frac{37 \times 40}{20 \times 240} = £\frac{37}{20 \times 6} = £\frac{1\cdot85}{6}$

$= \cdot30833\ldots$ of £1.

(11) 3·45 of a guinea $= \frac{3\cdot45 \times 10\frac{1}{2}}{2\frac{1}{2}}$ of 2*s.* 6*d.*

$= (\cdot69 \times 21)$ of 2*s.* 6*d.* $= 14\cdot49$ of 2*s.* 6*d.*;

$\frac{7}{15}$ of 4 lbs. 15 dwts. $= \dfrac{\frac{7}{15} \times 975 \times 24}{5760}$ lb. Troy

$= \frac{91}{48}$ of a lb. Troy $= 1\cdot895833\ldots$ of a lb. Troy;

$\frac{7}{15}$ of 4 lbs. 15 dwts. $= \dfrac{\frac{7}{15} \times 975 \times 24}{7000}$ lb. Avoird.

$= \frac{156}{100}$ lb. Avoird. $= 1\cdot56$ of a lb. Avoird.

(12) $$\cdot\dot{0}\dot{5} \text{ of } \dot{0}\dot{6} \text{ of a mi.} = \frac{\frac{5}{99}\times\frac{6}{99}}{3}\text{ lea.} = \frac{5\times 2}{99\times 99}\text{ lea.}$$

$= \cdot001020304\ldots$ of a lea.;

$$\frac{2}{5} \text{ of } 2 \text{ cwt. } 16 \text{ lbs.} = \frac{\frac{2}{5}\times 240}{\frac{7}{3}\times 20\times 112} \text{ of } 2\tfrac{1}{3} \text{ tons}$$

$$= \frac{9}{7\times 10\times 7} \text{ of } 2\tfrac{1}{3} \text{ tons} = \cdot018367\ldots \text{ of } 2\tfrac{1}{3} \text{ tons.}$$

2. $$\begin{array}{r} £16\cdot73125 \\ 20 \\ \hline 14\cdot62500s. \\ 12 \\ \hline 7\cdot500d. \end{array} \qquad \cdot\dot{3} \text{ of } 7s.\ 6d. = \frac{1}{3} \text{ of } 7s.\ 6d. = 2s.\ 6d. \qquad \begin{array}{r} 3\cdot785 \\ 4 \\ \hline 15\cdot140d. \end{array}$$

$\therefore$ £16·73125 + $\cdot\dot{3}$ of 7*s.* 6*d.* + 3·785 of 4*d.*
= £16. 14*s.* 7·5*d.* + 2*s.* 6*d.* + 1*s.* 3·14*d.* = £16. 18*s.* 4·64*d.*

$$\begin{array}{r|l} 12 & 4\cdot64 \\ \hline 2,0 & 18\cdot38666\ldots \\ \hline 2,0 & 16\cdot919333\ldots \\ \hline & \cdot8459666\ldots \end{array} \qquad \begin{array}{r|l} 12 & 4\cdot64 \\ \hline 21\begin{cases}3\\7\end{cases} & \begin{array}{l} 338\cdot386666\ldots \\ \hline 112\cdot795555\ldots \end{array} \\ \hline 2,0 & 16\cdot113650\ldots \\ \hline & \cdot805682\ldots \end{array}$$

$\therefore$ Answers are ·8459666… and ·805682…

3. $$\frac{6}{7} \text{ of } £1 + \frac{3}{8} \text{ of a guinea} + \frac{3}{560} \text{ of } 6s.\ 8d. + \frac{1}{14} \text{ of } 2s.\ 6d.$$

$$= 17s.\ 1\tfrac{5}{7}d. + 7s.\ 10\tfrac{1}{2}d. + \frac{3}{7}d. + 2\tfrac{1}{7}d.$$

$$= £1.\ 5s.\ 2\tfrac{11}{14}d.$$

$$\begin{array}{r|l} 14\begin{cases}2\\7\end{cases} & \begin{array}{l} 11\cdot \\ \hline 5\cdot5 \end{array} \\ \hline 12 & 2\cdot7857142\ldots \\ \hline 2,0 & 25\cdot2321428\ldots \\ \hline 100 & 1\cdot26160714\ldots \\ \hline & \cdot01261607\ldots \end{array} \qquad \begin{array}{r|l} 14\begin{cases}2\\7\end{cases} & \begin{array}{l} 11\cdot \\ \hline 5\cdot5 \end{array} \\ \hline 6 & 2\cdot7857142\ldots \\ \hline 21\begin{cases}3\\7\end{cases} & \begin{array}{l} 50\cdot464285\ldots \\ \hline 16\cdot821428\ldots \end{array} \\ \hline & 2\cdot40306\ldots \end{array}$$

4. $1 \text{ sheet} = \dfrac{\frac{1}{8}}{24} \text{ of an in.} = \dfrac{{\cdot}125}{24} \text{ of an in.}$

$$= \frac{{\cdot}015625}{3} \text{ of an in.} = {\cdot}00520833\ldots \text{ of an in.}$$

MISCELLANEOUS EXAMPLES IN DECIMALS.

Ex. XXVIII. Page 82.

1. No. of men $= {\cdot}3 \times 2000 = 600$,
.... women $= {\cdot}175 \times 2000 = 350$;
∴ No. of children $= 2000 - (600 + 350) = 1050$.

2. Denoting estate by unity, or 1,
residue of estate $= 1 - ({\cdot}45 + {\cdot}25) = {\cdot}3$.

Now $\dfrac{3}{10} = £100$;

∴ $\dfrac{1}{10} = \dfrac{1}{3}$ of £100 = £33. 6*s*. 8*d*.;

∴ 1, or unity, or estate = £33. 6*s*. 8*d*. × 10
= £333. 6*s*. 8*d*.

3.
$$\begin{array}{r|l} 12 & 6{\cdot} \\ \cline{2-2} 2,0 & 10{\cdot}5 \\ \cline{2-2} & {\cdot}525 \end{array}$$

∴ £1. 10*s*. 6*d*. = £1·525
= 15*fl*. 2*c*. 5*m*.

$$\begin{array}{r|l} 4 & 2{\cdot} \\ \cline{2-2} 12 & 9{\cdot}5 \\ \cline{2-2} 2,0 & 16{\cdot}79166 \\ \cline{2-2} & {\cdot}8395833 \end{array}$$

∴ 16*s*. $9\frac{1}{2}$*d*. = 8*fl*. 8*c*. $9{\cdot}58\frac{1}{3}$*m*.

$$\begin{array}{r|l} 4 & 3{\cdot} \\ \cline{2-2} 12 & 0{\cdot}75 \\ \cline{2-2} 2,0 & {\cdot}0625 \\ \cline{2-2} & {\cdot}003125 \end{array}$$

∴ £2. 0*s*. $0\frac{3}{4}$*d*. = £2·003125
= 20*fl*. 0*c*. $3\frac{1}{8}$*m*.

$$\begin{array}{r|l} 19 & 11{\cdot}15 \\ \cline{2-2} 2,0 & 19{\cdot}929166\ldots \\ \cline{2-2} & {\cdot}9964583\ldots \end{array}$$

∴ 19*s*. 11·15*d*. = 9*fl*. 9*c*. $6{\cdot}458\frac{1}{3}$*m*.

4. $$\cdot025 \times \cdot07 = \frac{25}{1000} \times \frac{7}{100} = \frac{175}{100000};$$

$$11\cdot035 \times \cdot0008 = \frac{11035}{1000} \times \frac{8}{10000} = \frac{88280}{10000000} = \frac{8828}{1000000};$$

$$\cdot1\dot{9} \times \cdot00\dot{3} = \frac{18}{90} \times \frac{3}{900} = \frac{54}{81000} = \frac{2}{3000} = \frac{2000}{3000000};$$

therefore the equivalent fractions are

$$\frac{175}{100000}, \quad \frac{8828}{1000000}, \quad \frac{2000}{3000000}$$

$$= \frac{5250}{3000000}, \quad \frac{26484}{3000000}, \quad \frac{2000}{3000000};$$

$\therefore$ $11\cdot035 \times \cdot0008$ is the greatest, and $\cdot1\dot{9} \times \cdot00\dot{3}$ is the least.

5. $\cdot7$ of 630 people $= 441\cdot0$, or 441 people,

$\cdot\dot{7}$ of 630 ...... $= \frac{7}{9}$ of 630, or 490 ......

$\cdot3\dot{6}$ of 630 ...... $= \frac{11}{30}$ of 630, or 231 ......

6. 1145 ac. 1 ro. $= 5543010$ sq. yds.;

$$\therefore \text{ No. of ares} = \frac{5543010}{119\cdot6033} = 46344\cdot9\ldots$$

= 463 hectar. 45 ares, nearly.

7. 1 lb. Avoird. $= 7000$ grs.

1 gram. $= 15\cdot432$ grs.;

$$\therefore \text{ Ans.} = \frac{7000}{15\cdot432} \text{ grammes} = 453\cdot602\ldots \text{ grammes}$$

= 4 hectog. 5 décag. 3 gr. 6·02... décig.

1 lb. Troy = 5760 grs.;

$$\therefore \text{ Ans.} = \frac{5760}{15\cdot432} \text{ grammes} = 373\cdot25\ldots \text{ grammes}$$

= 3 hectog. 7 décag. 3 gr. 2·5... décig.

167 stères 4 décist. $= 167\cdot4$ stères;

$\therefore$ No. of cub. ft. $= (35\cdot317 \times 167\cdot4) = 5912\cdot0658$

= 5912 cub. ft. 113·7024 cub. in.

8. $$\text{No.} = \frac{851 \times \cdot 00016}{\cdot 032} = \frac{851}{2 \times 100} = \frac{425\cdot 5}{100} = 4\cdot 255.$$

9. $$\text{A Nap.} = \frac{20}{25\cdot 15} \text{ of } £1 = \frac{4}{5\cdot 03} \text{ of } £1$$

$$= \frac{16}{5\cdot 03} \text{ of } 5s. = 3\cdot 1809\ldots \text{ of } 5s.$$

$$= \frac{32}{5\cdot 03} \text{ of } 2s.\ 6d. = 6\cdot 3618\ldots \text{of } 2s.\ 6d.$$

$$= \frac{40}{5\cdot 03} \text{ of } 2s. = 7\cdot 9522\ldots \text{ of } 2s.$$

$$= \frac{80}{5\cdot 03} \text{ of } 1s. = 15\cdot 9045\ldots \text{ of } 1s.$$

$$= \frac{160}{5\cdot 03} \text{ of } 6d. = 31\cdot 809\ldots \text{ of } 6d.$$

$$= \frac{240}{5\cdot 03} \text{ of } 4d. = 47\cdot 713\ldots \text{ of } 4d.$$

$$= \frac{320}{5\cdot 03} \text{ of } 3d. = 63\cdot 618\ldots \text{ of } 3d.$$

$$10 \text{ francs} = \frac{10}{25\cdot 15} \text{ of } £1 = \frac{8}{5\cdot 03} \text{ of } 5s. = 1\cdot 59045\ldots \text{of } 5s.$$

$$= \frac{16}{5\cdot 03} \text{ of } 2s.\ 6d. = 3\cdot 1809\ldots \text{of } 2s.\ 6d.$$

$$= \frac{20}{5\cdot 03} \text{ of } 2s. = 3\cdot 9761\ldots \text{of } 2s.$$

$$= \frac{40}{5\cdot 03} \text{ of } 1s. = 7\cdot 9522\ldots \text{of } 1s.$$

$$= \frac{80}{5\cdot 03} \text{ of } 6d. = 15\cdot 9045\ldots \text{of } 6d.$$

$$= \frac{120}{5\cdot 03} \text{ of } 4d. = 23\cdot 8567\ldots \text{of } 4d.$$

$$= \frac{160}{5\cdot 03} \text{ of } 3d. = 31\cdot 8091\ldots \text{of } 3d.$$

10. (1) Bin holds $3\frac{1}{2}$ qrs. $(3\frac{1}{2}\times 8\times 8)$ gals. $=224$ gals.;

∴ bin contains $(224\times 277\cdot274)$ cub. in.

$$=\frac{224\times 277\cdot274}{61\cdot028}\text{ litres}$$

$$=1017\cdot719\ldots\text{litres.}$$

(2) Barrel contains $\frac{36\times 277\cdot274}{61\cdot028}$ litres

$$=163\cdot562\ldots\text{litres.}$$

11.

$$\begin{array}{r|l}
12 & 8\cdot \\ \hline
3 & 1\cdot6666 \\ \hline
2 & 74\cdot5555 \\ \hline
11 & 37\cdot27777 \\ \hline
 & 3\cdot388888
\end{array}$$

Ans. $=3\cdot3\dot{8}$ chains

$=3$ chains, 3 chainlets, 8 links, $8\cdot\dot{8}$ linklets.

12. Minute-hand travels per week

$$=7\times 3\cdot14159\times 24\times 7\times 12\text{ in.}$$

Hour-hand travels per week $=(64\times 3\cdot14159\times 2\times 7)$ in.;

∴ No. of in. minute-hand travels more in a week than hour-hand

$$=7\times 3\cdot14159\times 24\times 7\times 12-64\times 3\cdot14159\times 2\times 7$$
$$=7\times 16\times 3\cdot14159\times \{126-8\}$$
$$=7\times 16\times 3\cdot14159\times 118;$$

∴ No. of metres minute-hand travels more in a week than hour-hand

$$=\frac{7\times 16\times 3\cdot14159\times 118}{39\cdot3708}$$
$$=1054\cdot56\ldots\ldots$$
$$=1054\tfrac{1}{2}\text{ nearly.}$$

SQUARE ROOT.—Ex. XXIX. Page 89.

1. (1)

$$\begin{array}{r|l} & \dot{1}6\dot{9}\ (13 \\ & 1 \\ 23 & 69 \\ & 69 \end{array} \qquad \begin{array}{r|l} & \dot{3}2\dot{4}\ (18 \\ & 1 \\ 28 & 224 \\ & 224 \end{array} \qquad \begin{array}{r|l} & 72\dot{9}\ (27 \\ & 4 \\ 47 & 329 \\ & 329 \end{array}$$

$$\begin{array}{r|l} & 1\dot{2}2\dot{5}\ (35 \\ & 9 \\ 65 & 325 \\ & 325 \end{array} \qquad \begin{array}{r|l} & 1\dot{6}8\dot{1}\ (41 \\ & 16 \\ 81 & 81 \\ & 81 \end{array}$$

$$\begin{array}{r|l} & 5\dot{7}7\dot{6}\ (76 \\ & 49 \\ 146 & 876 \\ & 876 \end{array} \qquad 8\dot{1}0\dot{0}\ (90$$

(2)

$$\dot{1}0\dot{0}0\dot{0}\ (100 \qquad \begin{array}{r|l} & \dot{1}2\dot{7}6\dot{9}\ (113 \\ & 1 \\ 21 & 27 \\ & 21 \\ 223 & 669 \\ & 669 \end{array} \qquad \begin{array}{r|l} & \dot{4}1\dot{2}0\dot{9}\ (203 \\ & 4 \\ 403 & 1209 \\ & 1209 \end{array}$$

$$\begin{array}{r|l} & 7\dot{1}7\dot{4}0\dot{9}\ (847 \\ & 64 \\ 164 & 774 \\ & 656 \\ 1687 & 11809 \\ & 11809 \end{array} \qquad \begin{array}{r|l} & 9\dot{4}8\dot{6}7\dot{6}\ (974 \\ & 81 \\ 187 & 1386 \\ & 1309 \\ 1944 & 7776 \\ & 7776 \end{array}$$

(3)

$$\begin{array}{r|l} & \dot{7}3\dot{0}0\dot{8}0\dot{4}\ (2702 \\ & 4 \\ 47 & 330 \\ & 329 \\ 5402 & 10804 \\ & 10804 \end{array} \qquad \begin{array}{r|l} & 1\dot{6}7\dot{5}2\dot{6}4\dot{9}\ (4093 \\ & 16 \\ 809 & 7526 \\ & 7281 \\ 8183 & 24549 \\ & 24549 \end{array}$$

```
        97535376 (9876
        81
  188 | 1653
      | 1504
 1967 |  14953
      |  13769
19746 |   118476
      |   118476
```

```
       289170025 (17005
       1
   27 | 189
      | 189
34005 |    170025
      |    170025
```

```
(4)     50·2681 (7·09
        49
 1409 | 12681
      | 12681
```

```
          5186·160225 (72·015
          49
   142 | 286
       | 284
 14401 |    21602
       |    14401
144025 |     720125
       |     720125
```

```
     ·0001695204 (·01302
        1
  23 | 69
     | 69
2602 |   5204
     |   5204
```

```
          1·5241578750190521 (1·23456789
          1
       22 | 52
          | 44
      243 |  841
          |  729
     2464 |  11257
          |   9856
    24685 |   140187
          |   123425
   246906 |    1676250
          |    1481436
  2469127 |     19481419
          |     17283889
 24691348 |      219753005
          |      197530784
246913569 |       2222222121
          |       2222222121
```

2. (1) 19·00000000 (4·3588...

	16
83	300
	249
865	5100
	4325
8708	77500
	69664
87168	783600
	697344
	86256

72·00000000 (8·4852...

	64
164	800
	656
1688	14400
	13504
16965	89600
	84825
169702	477500
	339404
	138096

(2) 7·00000000 (2·6457

	4
46	300
	276
524	2400
	2096
5285	30400
	26425
52907	397500
	370349
	27151

·12100000 (·3478
9
64 | 310
256
687 | 5400
4809
6948 | 59100
55584
3516

(3) 761·9000000 (27·6025
4
47 | 361
329
546 | 3290
3276
55202 | 140000
110404
552045 | 2959600
2760225
199375

·00038410 (·0195
1
29 | 284
261
385 | 2310
1925
385

3. (1) 1225 (35
9
65 | 325
325

9216 (96
81
186 | 1116
1116

$$\therefore \sqrt{\frac{1225}{9216}} = \frac{35}{96}.$$

$$\begin{array}{r|l}
 & 1\dot{5}2\dot{1}\ (39 \\
 & 9 \\ \hline
69 & 621 \\
 & 621 \\ \hline
\end{array}
\qquad\qquad
\begin{array}{r|l}
 & 6\dot{3}2\dot{0}2\dot{5}\ (795 \\
 & 49 \\ \hline
149 & 1420 \\
 & 1341 \\ \hline
1585 & 7925 \\
 & 7925 \\ \hline
\end{array}$$

$$\therefore \sqrt{\frac{1521}{632025}} = \frac{39}{795}.$$

(2) $3\frac{2}{3} = 3{\cdot}666666\ldots$

$$\begin{array}{r|r}
 & \dot{3}{\cdot}6\dot{6}6\dot{6}6\dot{6}\ldots\ (1{\cdot}9148\ldots \\
 & 1 \\ \hline
29 & 266 \\
 & 261 \\ \hline
381 & 566 \\
 & 381 \\ \hline
3824 & 18566 \\
 & 15296 \\ \hline
38288 & 327000 \\
 & 306304 \\ \hline
 & 20696
\end{array}$$

$$33\tfrac{144}{225} = \frac{7569}{225};$$

$$\begin{array}{r|l}
 & 7\dot{5}6\dot{9}\ (87 \\
 & 64 \\ \hline
167 & 1169 \\
 & 1169 \\ \hline
\end{array}
\qquad\qquad
\begin{array}{r|l}
 & \dot{2}2\dot{5}\ (15 \\
 & 1 \\ \hline
25 & 125 \\
 & 125 \\ \hline
\end{array}$$

$$\therefore \sqrt{33\tfrac{144}{225}} = \frac{87}{15} = 5\tfrac{4}{5}.$$

(3)

$$\begin{array}{r|r}
 & 1\dot{2}{\cdot}3\dot{1}4\dot{1}4\dot{1}\ldots\ (3{\cdot}509\ldots \\
 & 9 \\ \hline
65 & 331 \\
 & 325 \\ \hline
7009 & 64141 \\
 & 63081 \\ \hline
 & 1060
\end{array}
\qquad\qquad
\begin{array}{r|r}
 & {\cdot}0\dot{7}9\dot{5}5\dot{5}5\dot{5}\ (\cdot28205\ldots \\
 & 4 \\ \hline
48 & 395 \\
 & 384 \\ \hline
562 & 1155 \\
 & 1124 \\ \hline
56405 & 315555 \\
 & 282025 \\ \hline
 & 33530
\end{array}$$

(4) $\sqrt{\frac{3\frac{1}{2}}{4\frac{1}{2}}}=\sqrt{\frac{7}{9}}=\sqrt{\frac{7}{3}}=\frac{2\cdot6457\ldots}{3}=\cdot8819\ldots$

$$\begin{array}{r|l}
 & 1\dot{2}0\dot{8}8\dot{8}\cdot6\dot{8}3\dot{7}9\dot{0}2\dot{5}\ (347\cdot6905 \\
 & 9 \\ \hline
64 & 308 \\
 & 256 \\ \hline
687 & 5288 \\
 & 4809 \\ \hline
6946 & 47968 \\
 & 41676 \\ \hline
69529 & 629237 \\
 & 625761 \\ \hline
6953805 & 34769025 \\
 & 34769025 \\ \hline
\end{array}$$

4. 18 ac. 36 po. = 2916 po. = $(2916\times30\frac{1}{4})$ sq. yds.
= (729×121) sq. yds.

Now $\sqrt{(729\times121)}=(27\times11)=297$.

∴ Ans. = 297 yds.

5. No. of sq. yds. $=\frac{9245}{45}=\frac{1849}{9}$;

$$\begin{array}{r|l}
 & 1\dot{8}4\dot{9}\ (43 \\
 & 16 \\ \hline
83 & 249 \\
 & 249 \\ \hline
\end{array}$$

∴ side of court-yard $=\frac{43}{3}$ yds. = 14 yds. 1 ft.

6. 2 hectar. 56·333 ares = 256·333 ares = 25633·3 sq. m.

$$\begin{array}{r|l}
 & \dot{2}5\dot{6}3\dot{3}\cdot3\dot{0}\ldots\ (160\cdot104\ldots\ \text{m.} \\
 & 1 \\ \hline
26 & 156 \\
 & 156 \\ \hline
3201 & 3330 \\
 & 3201 \\ \hline
320204 & 1290000 \\
 & 1280816 \\ \hline
 & 9184
\end{array}$$

7. Area of circle $= \{3\cdot1416 \times (15)^2\}$ sq. yds.
$= (3\cdot1416 \times 225)$ sq. yds. $= 706\cdot8600$ sq. yds.

$$\begin{array}{r|l}
 & \dot{7}0\dot{6}\cdot8\dot{6}0\dot{0}\ldots\ (26\cdot586 \\
 & 4 \\ \hline
46 & 306 \\
 & 276 \\ \hline
525 & \ 3086 \\
 & \ 2625 \\ \hline
5308 & \ \ 46100 \\
 & \ \ 42464 \\ \hline
53166 & \ \ \ 363600 \\
 & \ \ \ 318996 \\ \hline
 & \ \ \ \ 44604
\end{array}$$

$\therefore$ side of square $= 26\cdot586\ldots$ yds.

8. In 6 hours one travels 72 miles,
.... the other .... 54 ......

and since they go in directions at right angles to each other,

$$\text{distance in miles} = \sqrt{(72)^2 + (54)^2} = \sqrt{(5184 + 2916)}$$
$$= \sqrt{8100} = 90.$$

CUBE ROOT.—Ex. XXX. Page 96.

1. (1)

$$\begin{array}{r|l}
 & \dot{2}74\dot{4}\ (14 \\
 & 1 \\ \hline
3 \times 1^2 = 3 & 1744 \\
3 \times 10^2 = 300 & \\
3 \times 10 \times 4 = 120 & \\
4^2 = \underline{\ 16} & \\
\overline{436} & \\
\underline{4} & \\
1744 & \underline{1744}
\end{array}$$

$$
\begin{array}{r|l}
 & 1\dot{7}57\dot{6}\ (26 \\
 & 8 \\ \hline
3\times2^2=12 & 9576 \\
3\times(20)^2=1200 & \\
3\times20\times6=\ \ 360 & \\
6^2=\ \ \ 36 & \\
\overline{1596} & \\
6 & \\
\overline{9576} & 9576 \\ \hline
\end{array}
$$

$$
\begin{array}{r|l}
 & 5\dot{4}87\dot{2}\ (38 \\
 & 27 \\ \hline
3\times3^2=27 & 27872 \\
3\times(30)^2=2700 & \\
3\times30\times8=\ \ 720 & \\
8^2=\ \ \ 64 & \\
\overline{3484} & \\
8 & \\
\overline{27872} & 27872 \\ \hline
\end{array}
$$

(2) $12\dot{5}00\dot{0}\ (50$

$$
\begin{array}{r|l}
 & 28\dot{7}49\dot{6}\ (66 \\
 & 216 \\ \hline
3\times(6)^2=108 & 71496 \\
3\times(60)^2=10800 & \\
3\times(60)\times6=\ \ 1080 & \\
6^2=\ \ \ \ 36 & \\
\overline{11916} & \\
6 & \\
\overline{71496} & 71496 \\ \hline
\end{array}
$$

(3)

$$
\begin{array}{r|l}
 & 35\dot{7}91\dot{1}\ (71 \\
 & 343 \\ \hline
3\times7^2=147 & 14911 \\
3\times(70)^2=14700 & \\
3\times70\times1=\ \ \ 210 & \\
1^2=\ \ \ \ \ 1 & \\
\overline{14911} & 14911 \\ \hline
\end{array}
$$

$$\begin{array}{rr|l}
 & & 70\dot{4}96\dot{9}\ (89 \\
 & & 512 \\ \cline{3-3}
3\times 8^2 = & 192 & 192969 \\
3\times(80)^2 = & 19200 & \\
3\times 80\times 9 = & 2160 & \\
9^2 = & 81 & \\ \cline{2-2}
 & 21441 & \\
 & 9 & \\ \cline{2-2}
 & 192969 & 192969 \\ \cline{3-3}
\end{array}$$

$$\begin{array}{rr|l}
 & & 94\dot{1}19\dot{2}\ (98 \\
 & & 729 \\ \cline{3-3}
3\times 9^2 = & 243 & 212192 \\
3\times(90)^2 = & 24300 & \\
3\times 90\times 8 = & 2160 & \\
8^2 = & 64 & \\ \cline{2-2}
 & 26524 & \\
 & 8 & \\ \cline{2-2}
 & 212192 & 212192 \\ \cline{3-3}
\end{array}$$

$$\begin{array}{rr|l}
 & & 68\dot{1}47\dot{2}\ (88 \\
 & & 512 \\ \cline{3-3}
3\times 8^2 = & 192 & 169472 \\
3\times(80)^2 = & 19200 & \\
3\times 80\times 8 = & 1920 & \\
8^2 = & 64 & \\ \cline{2-2}
 & 21184 & \\
 & 8 & \\ \cline{2-2}
 & 169472 & 169472 \\ \cline{3-3}
\end{array}$$

$$\begin{array}{rr|l}
 & & 75\dot{3}57\dot{1}\ (91 \\
 & & 729 \\ \cline{3-3}
3\times 9^2 = & 243 & 24571 \\
3\times(90)^2 = & 24300 & \\
3\times 90\times 1 = & 270 & \\
1^2 = & 1 & \\ \cline{2-2}
 & 24571 & \\
 & 1 & \\ \cline{2-2}
 & 24571 & 24571 \\ \cline{3-3}
\end{array}$$

(4) $3\dot{1}85\dot{5}01\dot{3}$ (317

	27
$3\times 3^2=27$	4855
$3\times(30)^2=2700$	
$3\times 30\times 1=\ \ 90$	
$1^2=\ \ 1$	
2791	
1	
2791	2791
$3\times(31)^2=2883$	2064013
$3\times(310)^2=288300$	
$3\times 310\times 7=\ \ 6510$	
$7^2=\ \ 49$	
294859	
7	
2064013	2064013

$\dot{1}09\dot{2}72\dot{7}$ (103

	1
$3\times(10)^2=300$	92727
$3\times(100)^2=30000$	
$3\times 100\times 3=\ \ 900$	
$3^2=\ \ 9$	
30909	
3	
92727	92727

$\dot{2}51\dot{5}45\dot{6}$ (136

	1
$3\times 1^2=3$	1515
$3\times(10)^2=300$	
$3\times 10\times 3=\ \ 90$	
$3^2=\ \ 9$	
399	
3	
1197	1197
$3\times(13)^2=507$	318456
$3\times(130)^2=50700$	
$3\times 130\times 6=\ \ 2340$	
$6^2=\ \ 36$	
53076	
6	
318456	318456

	$2\dot{0}57\dot{0}82\dot{4}$ (274
	8
$3 \times 2^2 = 12$	12570
$3 \times (20)^2 = 1200$	
$3 \times 20 \times 7 = 420$	
$7^2 = 49$	
1669	
7	
11683	11683
$3 \times (27)^2 = 2187$	887824
$3 \times (270)^2 = 218700$	
$3 \times 270 \times 4 = 3240$	
$4^2 = 16$	
221956	
4	
887824	887824

(5)

	$12\dot{2}02\dot{3}93\dot{6}$ (496
	64
$3 \times 4^2 = 48$	58023
$3 \times (40)^2 = 4800$	
$3 \times 40 \times 9 = 1080$	
$9^2 = 81$	
5961	
9	
53649	53649
$3 \times (49)^2 = 7203$	4374936
$3 \times (490)^2 = 720300$	
$3 \times 490 \times 6 = 8820$	
$6^2 = 36$	
729156	
6	
4374936	4374936

$$\begin{array}{r|l}
\multicolumn{2}{r}{13\dot{4}21\dot{7}72\dot{8}\ (512} \\
\multicolumn{2}{r}{125\qquad\qquad} \\ \cline{2-2}
3\times5^2=75 & \ \ 9217 \\
3\times(50)^2=7500 & \\
3\times50\times1=\ \ 150 & \\
1^2=\ \ \ \ \ \ 1 & \\ \cline{1-1}
7651 & \\
1 & \\ \cline{1-1}
7651 & \ \ 7651 \\ \hline
3\times(51)^2=7803 & 1566728 \\
3\times(510)^2=780300 & \\
3\times510\times2=\ \ \ \ 3060 & \\
2^2=\ \ \ \ \ \ \ \ \ 4 & \\ \cline{1-1}
783364 & \\
2 & \\ \cline{1-1}
1566728 & 1566728 \\ \cline{2-2}
\end{array}$$

$$\begin{array}{r|l}
\multicolumn{2}{r}{\dot{1}19\dot{4}38\dot{9}98\dot{1}\ (1061} \\
\multicolumn{2}{r}{1\qquad\qquad\qquad\quad} \\ \cline{2-2}
3\times(10)^2=300 & 194389 \\
3\times(100)^2=30000 & \\
3\times100\times6=\ \ 1800 & \\
6^2=\ \ \ \ \ 36 & \\ \cline{1-1}
31836 & \\
6 & \\ \cline{1-1}
191016 & 191016 \\ \hline
3\times(106)^2=33708 & 3373981 \\
3\times(1060)^2=3370800 & \\
3\times1060\times1=\ \ \ \ \ \ 3180 & \\
1^2=\ \ \ \ \ \ \ \ \ \ \ 1 & \\ \cline{1-1}
3373981 & \\
1 & \\ \cline{1-1}
3373981 & 3373981 \\ \cline{2-2}
\end{array}$$

(6)

$$\begin{array}{rr|l}
 & & 58\dot{6}37\dot{6}25\dot{3}\ (837 \\
 & & 512 \\ \cline{3-3}
 & 3\times 8^2=192 & 74376 \\
3\times(80)^2= & 19200 & \\
3\times 80\times 3= & 720 & \\
3^2= & 9 & \\ \cline{2-2}
 & 19929 & \\
 & 3 & \\ \cline{2-2}
 & 59787 & 59787 \\ \hline
 & 3\times(83)^2=20667 & 14589253 \\
3\times(830)^2= & 2066700 & \\
3\times 830\times 7= & 17430 & \\
7^2= & 49 & \\ \cline{2-2}
 & 2084179 & \\
 & 7 & \\ \cline{2-2}
 & 14589253 & 14589253 \\ \cline{3-3}
\end{array}$$

$$\begin{array}{rr|l}
 & & 2\dot{8}93\dot{4}44\dot{3}\ (307 \\
 & & 27 \\ \cline{3-3}
 & 3\times(30)^2=2700 & 1934443 \\
3\times(300)^2= & 270000 & \\
3\times 300\times 7= & 6300 & \\
7^2= & 49 & \\ \cline{2-2}
 & 276349 & \\
 & 7 & \\ \cline{2-2}
 & 1934443 & 1934443 \\ \cline{3-3}
\end{array}$$

$$\begin{array}{rr|l}
 & & 1\dot{2}23\dot{0}59\dot{0}46\dot{4}\ (2304 \\
 & & 8 \\ \cline{3-3}
 & 3\times 2^2=12 & 4230 \\
3\times(20)^2= & 1200 & \\
3\times 20\times 3= & 180 & \\
3^2= & 9 & \\ \cline{2-2}
 & 1389 & \\
 & 3 & \\ \cline{2-2}
 & 4167 & 4167 \\ \hline
 & 3\times(230)^2=158700 & 63590464 \\
3\times(2300)^2= & 15870000 & \\
3\times 2300\times 4= & 27600 & \\
4^2= & 16 & \\ \cline{2-2}
 & 15897616 & \\
 & 4 & \\ \cline{2-2}
 & 63590464 & 63590464 \\ \cline{3-3}
\end{array}$$

(7)

$$\begin{array}{r|l}
 & \dot{2}\cdot62\dot{8}07\dot{2}\ (1\cdot38 \\
 & 1 \\
\hline
3\times1^2=3 & 1628 \\
3\times(10)^2=300 & \\
3\times10\times3=\ \ 90 & \\
3^2=\ \ \ \ 9 & \\
\overline{399} & \\
3 & \\
\overline{1197} & \underline{1197} \\
3\times(13)^2=507 & 431072 \\
3\times(130)^2=50700 & \\
3\times130\times8=\ \ 3120 & \\
8^2=\ \ \ \ 64 & \\
\overline{53884} & \\
8 & \\
\overline{431072} & \underline{431072}
\end{array}$$

$$\begin{array}{r|l}
 & \cdot00\dot{0}91\dot{2}67\dot{3}\ (\cdot097 \\
 & 729 \\
\hline
3\times9^2=243 & 183673 \\
3\times(90)^2=24300 & \\
3\times90\times7=\ \ 1890 & \\
7^2=\ \ \ \ 49 & \\
\overline{26239} & \\
7 & \\
\overline{183673} & \underline{183673}
\end{array}$$

$$\begin{array}{r|l}
 & 2\dot{7}05\dot{4}03\dot{6}\cdot00\dot{8}\ (300\cdot2 \\
 & 27 \\
\hline
3\times(300)^2=270000 & 54036008 \\
3\times(3000)^2=27000000 & \\
3\times3000\times2=\ \ 18000 & \\
2^2=\ \ \ \ 4 & \\
\overline{27018004} & \\
2 & \\
\overline{54036008} & \underline{54036008}
\end{array}$$

(8) $$\sqrt[3]{\frac{8}{27}}=\frac{2}{3}.$$

	$\cdot 00\dot{0}10\dot{0}00\dot{0}$ ($\cdot 046\ldots$
	64
$3\times4^2=48$	36000
$3\times(40)^2=4800$	
$3\times40\times6=720$	
$6^2=36$	
5556	
6	
33336	33336
	2664

	$\dot{3}\cdot 00\dot{0}00\dot{0}00\dot{0}$ ($1\cdot 442\ldots$
	1
$3\times1^2=3$	2000
$3\times(10)^2=300$	
$3\times10\times4=120$	
$4^2=16$	
436	
4	
1744	1744
$3\times(14)^2=588$	256000
$3\times(140)^2=58800$	
$3\times140\times4=1680$	
$4^2=16$	
60496	
4	
241984	241984
$3\times(144)^2=62208$	14016000
$3\times(1440)^2=6220800$	
$3\times1440\times2=8640$	
$2^2=4$	
6229444	
2	
12458888	12458888
	1557112

$$
\begin{array}{r|l}
 & \cdot 300000000\ (\cdot 669\ldots \\
 & 216 \\ \hline
3\times 6^2=108 & 84000 \\
3\times(60)^2=10800 & \\
3\times 60\times 6=\quad 1080 & \\
6^2=\quad 36 & \\ \cline{1-1}
11916 & \\
6 & \\ \cline{1-1}
71496 & 71496 \\ \hline
3\times(66)^2=13068 & 12504000 \\
3\times(660)^2=1306800 & \\
3\times 660\times 9=\quad 17820 & \\
9^2=\quad 81 & \\ \cline{1-1}
1324701 & \\
9 & \\ \cline{1-1}
11922309 & 11922309 \\ \hline
 & 581691
\end{array}
$$

$$
\begin{array}{r|l}
 & 517\cdot 000000000\ (8\cdot 025\ldots \\
 & 512 \\ \hline
3\times(80)^2=19200 & 5000000 \\
3\times(800)^2=1920000 & \\
3\times 800\times 2=\quad 4800 & \\
2^2=\quad 4 & \\ \cline{1-1}
1924804 & \\
2 & \\ \cline{1-1}
3849608 & 3849608 \\ \hline
3\times(805)^2=1944075 & 1150392000 \\
3\times(8050)^2=194407500 & \\
3\times 8050\times 5=\quad 120750 & \\
5^2=\quad 25 & \\ \cline{1-1}
194528275 & \\
5 & \\ \cline{1-1}
972641375 & 972641375 \\ \hline
 & 177750625
\end{array}
$$

$4\dot{4}\cdot60\dot{0}00\dot{0}00\dot{0}$ (3·546...

27

$3 \times 3^2 = 27$ | 17600

$3 \times (30)^2 = 2700$

$3 \times 30 \times 5 = 450$

$5^2 = 25$

3175

5

15875 | 15875

$3 \times (35)^2 = 3675$ | 1725000

$3 \times (350)^2 = 367500$

$3 \times 350 \times 4 = 4200$

$4^2 = 16$

371716

4

1486864 | 1486864

$3 \times (354)^2 = 375948$ | 238136000

$3 \times (3540)^2 = 37594800$

$3 \times 3540 \times 6 = 63720$

$5^2 = 36$

37658556

6

225951336 | 225951336

12184664

$5\dot{0}65\dot{3}$ (37

27

$3 \times 3^2 = 27$ | 23653

$3 \times (30)^2 = 2700$

$3 \times 30 \times 7 = 630$

$7^2 = 49$

3379

7

23653 | 23653

$$\begin{array}{r|l} & \dot{1}36\dot{7}63\dot{1}\ (111 \\ & 1 \\ \hline 3\times1^2=3 & 367 \\ 3\times(10)^2=300 & \\ 3\times10\times1=\ \ 30 & \\ 1^2=\ \ \ 1 & \\ \overline{331} & \\ 1 & \\ \overline{331} & 331 \\ \hline 3\times(11)^2=363 & 36631 \\ 3\times(110)^2=36300 & \\ 3\times110\times1=\ \ \ 330 & \\ 1^2=\ \ \ \ 1 & \\ \overline{36631} & \\ 1 & \\ \overline{36631} & 36631 \\ \hline \end{array}$$

$$\therefore \sqrt[3]{\frac{50653}{1367631}}=\frac{37}{111}=\frac{1}{3}.$$

2.

$$\begin{array}{r|r} & \cdot0\dot{0}0\dot{0}0\dot{0}4\dot{5}6\dot{9}7\dot{6}\ (\cdot000676 \\ & 36 \\ \hline 127 & 969 \\ & 889 \\ \hline 1346 & 8076 \\ & 8076 \\ \hline \end{array}$$

$$\begin{array}{r|r} & \cdot0\dot{0}0\dot{6}7\dot{6}\ (\cdot026 \\ & 4 \\ \hline 46 & 276 \\ & 276 \\ \hline \end{array}$$

Ans. $= \cdot026$.

$$
\begin{array}{r|l}
 & \cdot 00\dot{0}59\dot{4}82\dot{3}32\dot{1}\ (\cdot 0841 \\
 & 512 \\ \hline
3\times 8^2=192 & 82823 \\
3\times(80)^2=19200 & \\
3\times 80\times 4=\quad 960 & \\
4^2=\quad 16 & \\ \cline{1-1}
20176 & \\
4 & \\ \cline{1-1}
80704 & 80704 \\ \hline
3\times(84)^2=21168 & 2119321 \\
3\times(840)^2=2116800 & \\
3\times 840\times 1=\quad 2520 & \\
1^2=\quad 1 & \\ \cline{1-1}
2119321 & \\
1 & \\ \cline{1-1}
2119321 & 2119321 \\ \hline
\end{array}
$$

$$
\begin{array}{r|l}
 & \cdot 0\dot{8}4\dot{1}\ (\cdot 29 \\
 & 4 \\ \hline
49 & 441 \\
 & 441 \\ \hline
\end{array}
$$

Ans. $= \cdot 29$.

3. Length of edge $= \sqrt[3]{(233744896 \times \cdot 008)}$ in.;

$$
\begin{array}{r|l}
 & 2\dot{3}37\dot{4}48\dot{9}6\ (616 \\
 & 216 \\ \hline
3\times 6^2=108 & 17744 \\
3\times(60)^2=10800 & \\
3\times 60\times 1=\quad 180 & \\
1^2=\quad 1 & \\ \cline{1-1}
10981 & 10981 \\ \hline
3\times(61)^2=11163 & 6763896 \\
3\times(610)^2=1116300 & \\
3\times 610\times 6=\quad 10980 & \\
6^2=\quad 36 & \\ \cline{1-1}
1127316 & \\
6 & \\ \cline{1-1}
6763896 & 6763896 \\ \hline
\end{array}
$$

$\therefore$ length of edge $= (616 \times \cdot 2)$ in. $= 123\cdot 2$ in. $= 3$ yds. 1 ft. $3\frac{1}{5}$ in.

4. Since £15946. 17*s*. 6*d*. = 637875 sixpences,

no. of cubic ft. in mass = 637875 ÷ 7 = 91125;

$$\begin{array}{r|l} & 9\dot{1}12\dot{5}\,(45 \\ & 64 \\ \cline{2-2} 3\times4^2=48 & 27125 \\ 3\times(40)^2=4800 & \\ 3\times40\times5=600 & \\ 5^2=25 & \\ \cline{1-1} 5425 & \\ 5 & \\ \cline{1-1} 27125 & 27125 \\ \cline{2-2} \end{array}$$

∴ length of edge = 45 ft. = 15 yds.

MISCELLANEOUS QUESTIONS AND EXAMPLES.

I. Page 97.

1. (1) Time gained = $3\times365\frac{1}{4}\times33$, or $36159\frac{3}{4}$ hrs.

= 4 yrs. 180 d. 15 hrs. 45 min.

(2) The train travels $\frac{66\times20\times60\times36}{39\cdot3708}$ metres,

or $\frac{14256}{196\cdot8540}$ kilom., or 72·4... kilom. in an hour.

2. (1) 16 tons, 3 cwt. = 323 cwt.

Each two persons receive $4\frac{1}{4}$ cwt.

Now $323\div4\frac{1}{4}=19\times4=76$;

∴ No. of persons = 76 × 2 = 152.

(2)

$$\begin{array}{r} \text{fr.} \\ 411\cdot75 \\ 519\cdot09 \\ 134\cdot35 \\ 606\cdot29 \\ 64\cdot \\ \hline 1735\cdot48 \text{ fr.} \end{array}$$

Now $25{\cdot}325$ fr. $= £1$;

$$\therefore\ 1\text{ fr.} = \frac{1}{25{\cdot}325}\text{ of } £1;$$

$$\therefore\ 1735{\cdot}48\text{ fr.} = £\frac{1735{\cdot}48}{25{\cdot}325} = £68{\cdot}5\ldots;$$

$\therefore$ 7 ten-pound notes must be changed.

(3) $3\frac{1}{2}$ hectol. weigh $\left(\frac{7}{2}\times 94000\right)$ grs. $= 329$ kilog.;

$\therefore$ cask and wine weigh $(17{\cdot}45 + 329)$ kilog. $= 346{\cdot}45$ kilog.

$$\therefore\ \text{cost of carriage} = \left(\frac{34645}{10000}\times 430\right)c.$$

$$= 1489{\cdot}735c. = 14\,fr.\ 90c.\text{ nearly.}$$

3. (1)

$$\begin{array}{l}
345\,)\,624\,(1 \\
\underline{345} \\
279\,)\,345\,(1 \\
\underline{279} \\
66\,)\,279\,(4 \\
\underline{264} \\
15\,)\,66\,(4 \\
\underline{60} \\
6\,)\,15\,(2 \\
\underline{12} \\
3\,)\,6\,(2 \\
\underline{6}
\end{array}$$

$\therefore$ 3 is the G. C. M. required,

and L. C. M. required $= \dfrac{345\times 624}{3} = 115\times 624 = 71760.$

(2)

$$\begin{array}{r|l}
4 & 4,\ 8,\ 12,\ 20 \\
\hline
 & 2,\ \ 3,\ \ 5
\end{array}$$

$\therefore$ L. C. M. $= 4\times 2\times 3\times 5 = 120$;

$\therefore$ No. of sixpences required $= 120$.

4. (1) $(2\frac{1}{5}+3\frac{2}{9}+5\frac{3}{8})-(5\frac{4}{9}+\frac{3}{8}+\frac{7}{12}+2\frac{5}{24})$

$$=\left(10+\frac{72+80+135}{360}\right)-\left(7+\frac{32+27+42+15}{72}\right)$$

$$=10\frac{287}{360}-7\frac{116}{72}=(10-8)+\left(\frac{287}{360}-\frac{220}{360}\right)$$

$$=2\frac{67}{360}.$$

(2) $$\frac{1\frac{1}{2}\text{ of }\frac{1\frac{1}{3}}{2\frac{1}{4}}}{3\frac{1}{3}}\text{ of }\frac{\frac{1}{2}\text{ of }\frac{4}{5}}{4\frac{1}{2}\text{ of }\frac{1}{5}}\div\frac{\frac{1}{2}\text{ of }\frac{\frac{4}{5}}{\frac{3}{7}}}{\frac{3}{4}}$$

$$=\left(\frac{\cancel{3}}{\cancel{2}}\text{ of }\frac{4}{\cancel{3}}\times\frac{4}{9}\times\frac{3}{10}\text{ of }\frac{1}{2}\text{ of }\frac{4}{\cancel{5}}\times\frac{\cancel{2}}{9}\text{ of }\frac{\cancel{5}}{1}\right)$$

$$\div\left(\frac{1}{2}\text{ of }\frac{4}{5}\times\frac{7}{3}\times\frac{4}{3}\right)$$

$$=\frac{\cancel{4}\times\cancel{4}\times\cancel{3}\times\cancel{4}}{\cancel{3}\times\cancel{3}\times\cancel{2}\times\cancel{5}\times\cancel{2}\times\cancel{3}\times3}\times\frac{2\times\cancel{5}\times\cancel{3}\times\cancel{3}}{\cancel{4}\times7\times\cancel{4}}$$

$$=\frac{2}{3\times7}=\frac{2}{21}.$$

5. (1) *A*'s share + *B*'s share $=\left(\frac{1}{3}+\frac{7}{15}\right)$ or $\frac{4}{5}$ of ship;

∴ *C*'s share $=\frac{1}{5}$ of ship;

value of *C*'s share $=\frac{1}{5}$ of £45000 = £9000.

(2) A boy can dig $\frac{1}{6}$ ro. in 1 day,

a man .... $\frac{2}{9}$ ....;

∴ 2 men and 3 boys can dig

$$\left(\frac{4}{9}+\frac{1}{2}\right)\text{ or }\frac{17}{18}\text{ ro. in 1 day;}$$

∴ No. of days required $=\dfrac{34}{\frac{17}{18}}=\dfrac{34\times18}{17}=36.$

6. (1)

$$\begin{array}{rl} \cdot 0019\,) & 76\cdot 5700\,(40300 \\ & \underline{76} \\ & \;\;57 \\ & \;\;\underline{57} \end{array}$$

$$\frac{3}{7} \text{ of } \cdot 0008\dot{5}68 = 3 \times \cdot 0001224 = \cdot 0003672;$$

$$\therefore \text{product} = 40\dot{3}00 \times \cdot 0003672$$
$$= 14\cdot 79816.$$

(2)
$$\frac{3}{4} \text{ of } \frac{1}{9\frac{1}{2}} \text{ of } £1.\ 18s. = \frac{3}{4} \text{ of } \frac{2}{19} \text{ of } 38s. = 3s.$$

$$\frac{2}{3} \text{ of } \cdot 375 \text{ of } 15s. = \frac{2}{3} \text{ of } \frac{3}{8} \text{ of } 15s. = 3s.\ 9d.$$

$$\frac{2}{5} \text{ of } \cdot 4\dot{2}\dot{9} \text{ of } 8s.\ 3d. = \frac{2}{5} \text{ of } \frac{425}{990} \text{ of } 99d. = 1s.\ 5d.;$$

$$\therefore \text{sum} = 3s. + 3s.\ 9d. + 1s.\ 5d. = 8s.\ 2d.$$

$$\begin{array}{r|l} 12 & 2\cdot \\ \hline 100 & 8\cdot 1666 \\ \hline & \cdot 081\dot{6} \end{array}$$

$$\text{Ans.} = \cdot 081\dot{6}.$$

7. (1) $(\text{dist.})^2$ in feet $= (24)^2 + (45)^2 = 576 + 2025 = 2601,$

$$\begin{array}{r|l} & 2\dot{6}0\dot{1}\,(51 \\ & 25 \\ \hline 101 & \;101 \\ & \;\underline{101} \end{array}$$

$$\therefore \text{Ans.} = 51 \text{ feet.}$$

(2) £275. 12*s.* 6*d.* = 11025 sixpences,

£87. 12*s.* 1*d.* = 21025*d.*

$$\begin{array}{r|l} & \dot{1}10\dot{2}\dot{5}\,(105 \\ & 1 \\ \hline 205 & \;1025 \\ & \;\underline{1025} \end{array} \qquad \begin{array}{r|l} & \dot{2}10\dot{2}\dot{5}\,(145 \\ & 1 \\ \hline 24 & 110 \\ & \;\underline{96} \\ 285 & 1425 \\ & \underline{1425} \end{array}$$

∴ No. of boys in the upper forms = 105,
.... lower .... = 145;
∴ No. of boys in the school = 250.

8. (1) Average income-tax for the year

$$=\frac{9+7}{2}\,d.=8d.$$

$$\text{Income-tax}=\left(2063\times 8+\frac{45}{240}\times 8\right)d.=\pounds 68.\ 15s.\ 5\tfrac{1}{2}d.;$$

$$\therefore \text{net income}=\pounds 2063.\ 3s.\ 9d.-\pounds 68.\ 15s.\ 5\tfrac{1}{2}d.$$
$$=\pounds 1994.\ 8s.\ 3\tfrac{1}{2}d.$$

The carriage of 120 bales, of 90 kilog. each, costs 450 *fr.*

∴ .... 1 .... 5 *fr.*

∴ .... 1 .... 1 .... $\frac{1}{24}$ *fr.*

∴ .... 80 .... $\frac{10}{3}$ *fr.*

∴ .... 340 .... 80 .... $\frac{3400}{3}$ *fr.*

or 1133 *fr.* 33*c.* nearly.

Ex. II. Page 99.

1. (1) 5 gal. ÷ 5 qts. = 20 qts. ÷ 4 qts. = 4;
6 hrs. × 4 = 24 hrs.

Again, 5 qts. ÷ 5 gal. $=\frac{1}{4}$;

∴ 6 hrs. × $\frac{1}{4}$ = 1 hr. 30 min.

(2) 6 pumps discharge 64800 gal. in 12 hrs.,
∴ .... 5400 .... 1...
∴ 1 .... 900 ....
∴ .... 7200 .... 8...
∴ 10 .... 72000 ....

$$=\frac{72000\times 8}{1\cdot 76077}\text{ lit.}=327129\cdot 6\text{ lit.}$$

2. (1)

$$\begin{array}{r|rrrrrrr} 2 & 48, & 64, & \cancel{27}, & 81, & \cancel{33}. & 110, & 165 \\ \hline 8 & 24, & 32, & & 81, & & 55, & 165 \\ \hline 3 & \cancel{3}, & 4, & & 81, & & 55, & 165 \\ \hline & & 4, & & 27, & & 55, & 55 \end{array}$$

$\therefore$ L. C. M. $=2\times8\times3\times4\times27\times55=285120$.

(2) Find the L. C. M. of the sums named, expressed in pence,

$$\begin{array}{r|rrrrrrr} 4 & 1, & \cancel{12}, & \cancel{24}, & \cancel{30}, & \cancel{60}, & 240, & 252 \\ \hline 3 & & & & & & 60, & 63 \\ \hline & & & & & & 20, & 21 \end{array}$$

L. C. M. $=4\times3\times20\times21$;

$\therefore$ least sum of money $=(4\times3\times20\times21)d.=£21$.

3. (1) $$\frac{2}{7}\text{ of }\frac{1-\frac{2}{7}}{2}+\frac{4}{5}\times\frac{1}{10}+\frac{3}{5}\text{ of }\left(\frac{1}{2}+\frac{11}{14}\right)+\frac{3}{70}\text{ of }1\tfrac{3}{35}$$

$$=\frac{2}{7}\text{ of }\frac{5}{14}+\frac{2}{25}+\frac{3}{5}\text{ of }\left(\frac{18}{14}\right)+\frac{3}{70}\text{ of }\frac{38}{35}$$

$$=\frac{5}{49}+\frac{2}{25}+\frac{27}{35}+\frac{57}{35\times35}$$

$$=\frac{125+98+945+57}{35\times35}=\frac{1225}{1225}=1.$$

(2) $$\cfrac{1}{2+\cfrac{1}{4+\cfrac{1}{5}}}-\cfrac{1}{10+\cfrac{1}{2+\cfrac{1}{4}}}$$

$$=\cfrac{1}{2+\cfrac{5}{21}}-\cfrac{1}{10+\cfrac{4}{9}}$$

$$=\frac{21}{47}-\frac{9}{94}=\frac{42-9}{94}=\frac{33}{94}.$$

4. (1) Each part $=\frac{1}{3}\div4=\frac{1}{12}$;

$\therefore$ No. of parts $=\frac{5}{12}\div\frac{1}{12}=5$.

(2) Wheat 56*s.* a qr., lab. receives 12*s.*;

∴ .... 1*s.* .... ought to receive $\frac{12}{56}$*s.*;

∴ .... £2. 12*s.* 6*d.* .... $\frac{3}{14}$ of $52\frac{1}{2}$*s.* = 11*s.* 3*d.*

5.

	£	*s.*	*d.*
$19\frac{3}{4}$ yds. of silk at 6*s.* 7*d.* a yd. . . . . =	6	10	$0\frac{1}{4}$
$26\frac{5}{9}$ yds. of lace at 4*s.* 6*d.* a yd. . . . . =	5	19	6
$8\frac{1}{2}$ doz. pairs of gloves at 3*s.* 9*d.* a pair . =	19	2	6
$25\frac{1}{4}$ yds. of trimming at 2*s.* 10*d.* a yd. . =	3	11	$6\frac{1}{2}$
23 yds. of embroidery at 6*s.* $0\frac{3}{4}$*d.* a yd. . =	6	19	$5\frac{1}{4}$
9 doz. and 3 handkerchiefs at 4*s.* 11*d.* each =	27	5	9
$11\frac{1}{3}$ yds. of blonde at 4*s.* $9\frac{3}{4}$*d.* a yd. . . =	2	14	$6\frac{1}{2}$
$20\frac{3}{4}$ yds. of silk velvet at 17*s.* 6*d.* a yd. . =	18	3	$1\frac{1}{2}$
$19\frac{2}{5}$ yds. of sarcenet at 3*s.* $6\frac{1}{2}$*d.* a yd. . =	3	8	$8\frac{1}{2}$
A sealskin cloak . . . . =	21	0	0
	114	15	$1\frac{1}{2}$

∴ Ans. = £120 − £114. 15*s.* $1\frac{1}{2}$*d.* = £5. 4*s.* $10\frac{1}{2}$*d.*

6. (1) $\cdot 261\dot{5}38\dot{4}$ of £6. 10*s.* $= \left(\frac{2615832}{9999990} \text{ of } 130\right)$*s.* = 34*s.*

= £1. 14*s.*;

$\cdot\dot{5}\dot{4}$ of $\cdot 0\dot{2}\dot{7}$ of a mile $= \left(\frac{54}{99} \times \frac{27}{990} \times 1760\right)$ yds.

$= \frac{288}{11}$ yds. = 26 yds. $6\frac{6}{11}$ in.

(2) $\cdot\dot{4}2857\dot{1} = \frac{3}{7}$, and $\cdot 458\dot{3} = \frac{11}{24}$;

∴ If $\frac{3}{7}$ of an estate be worth $(450 \times 25{\cdot}125)$*fr.*

$\frac{1}{7}$ .... is ...... $(150 \times 25{\cdot}125)$*fr.*

∴ the estate is worth $(150 \times 25{\cdot}125 \times 7)$*fr.*

∴ $\frac{11}{24}$ of .... $\left(\frac{11}{24} \text{ of } 150 \times 25{\cdot}125 \times 7\right)$*fr.*

$= \frac{1}{4}$ of $48365{\cdot}625$*fr.*

= 12091*fr.* 40*c.* nearly.

7. (1) 5 balls of lead = 9 balls of iron,
.... = 21 balls of marble;
$\therefore$ 35 .... = (21×7) or 147 balls of marble.

(2) When the minute-hand has gained 60 minutes of the hour-hand, the hands will be together again.

Now 55′ is gained by minute-hand in 60′;

$\therefore$ 1′ .... $\dfrac{12'}{11}$;

$\therefore$ 60′ .... $\left(\dfrac{12 \times 60}{11}\right)'$;

$\therefore$ .... $65\frac{5}{11}'$;

$\therefore$ time required $= 5\frac{5}{11}'$ past 1 o'clock.

(3) He has 19*s*. 2*d*. or 230*d*., after paying rate on £1 or 240*d*.

$\therefore$ .... 1*d*. .... $\dfrac{240}{230}d.$;

$\therefore$ .... £1 .... $\pounds\dfrac{24}{23}$;

$\therefore$ .... £862. 10*s*. .... $\pounds\left(\dfrac{24}{23} \text{ of } 862\frac{1}{2}\right)$
$= \pounds900.$

(4) 9*d*. in the £ increased his in.-tax by (£52. 10*s*. − £18. 15*s*.) or £33. 15*s*.;

$\therefore$ sum on which he paid $= \pounds\dfrac{675}{\frac{3}{4}} = \pounds900$,

Now £900 pays £18. 15*s*. or 4500*d*. for in.-tax,
$\therefore$ £1 ...... 5*d*. ....

8. (1)

$$\begin{array}{r|l}
 & \dot{8}02\dot{4}\cdot02\dot{4}00\dot{8}\ (20\cdot02 \\
 & 8 \\
3 \times (200)^2 = 120000 & \overline{\quad 24024008} \\
3 \times (2000)^2 = 12000000 & \\
3 \times 2000 \times 2 = \quad 12000 & \\
2^2 = \quad 4 & \\
\overline{12012004} & \\
2 & \\
\overline{24024008} & \underline{\quad 24024008}
\end{array}$$

$$\begin{array}{r|r}
 & \cdot 00\dot{0}0\dot{3}000\dot{0}00\dot{0}\ (\cdot 0310\ldots \\
 & 27 \\
\hline
3\times 3^2=27 & 3000 \\
3\times(30)^2=2700 & \\
3\times 30\times 1=\quad 90 & \\
1^2=\quad 1 & \\
\overline{2791} & 2791 \\
\hline
3\times(31)^2=2883 & 209000
\end{array}$$

(2)

$$\begin{array}{rrrr}
\text{ac.} & \text{ro.} & \text{po.} & \text{yds.} \\
201 & 1 & 3 & 28\frac{1}{4}
\end{array}$$

$$\begin{array}{r}
4 \\
\hline
805 \\
40 \\
\hline
32203 \\
30\frac{1}{4} \\
\hline
966090 \\
8050\cdot 75 \\
28\cdot 25 \\
\hline
9\dot{7}4\dot{1}6\dot{9}\ (987 \\
81
\end{array}$$

$$\begin{array}{r|r}
188 & 1641 \\
 & 1504 \\
\hline
1967 & 13769 \\
 & 13769 \\
\hline
\end{array}$$

$\therefore$ length of side of field = 987 yds.

(3) 100 pears cost 50*d.*, 150 apples cost 75*d.*;

$\therefore$ whole cost = 125*d.*

I sell the pears for 75*d.*, the apples for 100*d.*;

$\therefore$ I sell the whole for 175*d.*;

$\therefore$ gain = (175 − 125)*d.* = 50*d.* = 4*s.* 2*d.*

Also, since by investing 125*d.* I gain 50*d.*,

$$\ldots\ldots\ldots\ldots\ 1d.\ \ldots\ldots\ \frac{50}{125}d.,$$

$$\ldots\ldots\ldots\ldots\ £1\ \ldots\ldots\ £\frac{50}{125},$$

$$\ldots\ldots\ldots\ldots\ £100\ \ldots\ldots\ £\frac{100\times 50}{125}=£40.$$

Ex. III. Page 102.

1. (1) $\frac{1}{12}$ is alloy,

alloy in 3 oz. 15 dwts. of standard gold $= \frac{1}{12}$ of 3 oz. 5 dwts.
$= 5$ dwts. 10 grs.

(2) No. of sq. m. in yard $= \dfrac{783\frac{9}{40}}{\frac{9}{40}} = 3481$;

$$\begin{array}{r|l} & \dot{3}4\dot{8}\dot{1}\,(59 \\ & 25 \\ \hline 109 & 981 \\ & 981 \\ \hline \end{array}$$

∴ side of square is 59 m.

2. (1) $84 - 44 = 40$;

By the question,

40 oranges are worth 2*s.* 6*d.*;

∴ 1 orange is worth $\frac{1}{40}$ of 2*s.* 6*d.* $= \frac{3}{4}$*d.*

(2) L. C. M. of 32 and $36 = 8 \times 9 \times 4$;

$$\therefore \text{Ans.} = \frac{36 \times 64}{8 \times 9 \times 4} = 8.$$

3. (1) $\frac{3}{4} + \frac{4}{5} + \frac{5}{6} = \frac{45 + 48 + 50}{60} = \frac{143}{60}$;

$$\frac{9}{10} \text{ of } \frac{21}{50} - \frac{9}{10} \text{ of } \frac{1}{50} = \frac{9}{10} \text{ of } \frac{20}{50}.$$

Now $\frac{143}{60} \times \frac{9}{10}$ of $\frac{2}{5} \div 333\frac{1}{3} = \frac{143}{30} \times \frac{9}{10} \times \frac{1}{5} \times \frac{3}{1000}$

$$= \frac{2574}{1000000} = \cdot002574.$$

(2) No. of times $= \frac{6}{55}$ of $\frac{3}{20}$ of $\frac{77}{72}$ of $40 \div \frac{4}{15}$ of $\frac{3}{40}$ of $\frac{30}{7} \times 21$

$$= \frac{6}{55} \times \frac{3}{20} \times \frac{77}{72} \times \frac{40}{1} \times \frac{15}{4} \times \frac{40}{3} \times \frac{7}{30} \times \frac{1}{21} = \frac{7}{18}.$$

(3) $\dfrac{\cdot003125 \times \cdot48}{\cdot0000125}$ of $\cdot06$ of $4\cdot2$ of a guinea

$$=\left(\frac{3125 \times 48}{125 \times 10} \times \frac{6}{100} \text{ of } \frac{42}{10} \times 21\right)s.$$

$$=\frac{12 \times 6 \times 42 \times 21}{100}\,s.;$$

$\therefore$ $\dfrac{\cdot003125 \times \cdot48}{\cdot0000125}$ of $\cdot06$ of $4\cdot2$ of a guinea

$$=\frac{12 \times 6 \times 42 \times 21}{100} \times \frac{1}{20 \times 100} \text{ of } £100$$

$$=\frac{31752}{100000} \text{ of } £100;$$

$\therefore$ dec. required $= \cdot31752$.

4. (1) $\dfrac{69}{9}$ or $7\frac{2}{3}$ = no. of hrs. the coach is travelling;

$\therefore$ $3\frac{2}{3}$ = ... train ....

$\therefore$ $\dfrac{69}{3\frac{2}{3}}$ or $\dfrac{69 \times 3}{11}$ = no. of mi. per hr. at which train travels;

$\therefore$ train travels $\dfrac{\frac{69 \times 3}{11}}{9}$ or $\dfrac{23}{11}$ or $2\frac{1}{11}$ times as fast as coach.

(2) By the question, *A* does $\frac{2}{3}$ of work in 4 hours,

B does $\frac{3}{4}$ of $\frac{1}{3}$ in 1 hr.;

$\therefore$ part of work done by *A* and $B = \frac{2}{3} + \frac{1}{4} = \frac{11}{12}$;

$\therefore$ *C* does $\frac{1}{12}$ in 20 min.

Representing the work by unity, or 1,

in 1 hour *A* does $\frac{1}{6}$ part of the work,

.... *B* ...... $\frac{1}{4}$ ....,

.... *C* ...... $\frac{1}{4}$ ....,

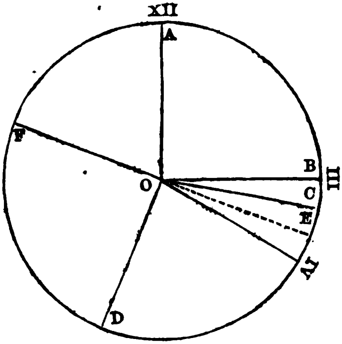
.... $A+B+C$ do $\left(\frac{1}{6}+\frac{1}{4}+\frac{1}{4}\right)$ part of the work,

$$=\frac{8}{12};$$

∴ No. of hours in which $A+B+C$ would finish the work

$$=\frac{1}{\frac{8}{12}}=\frac{12}{8}=1\tfrac{1}{2}.$$

(3) 1st. Let *OC* and *OD* represent the positions of the hour and minute-hands of the clock when they are 15′ apart between 3 and 4 o'clock.



In the time that the hour-hand has passed over *BC*, the minute-hand has passed over *AD*, and the minute-hand travels 12 times as fast as the hour-hand;

$$\therefore 12BC = AD = AB + BC + CD$$
$$= 15' + BC + 15'$$
$$= 30' + BC;$$

$\therefore$ 12 times BC − once $BC = 30'$ + once BC − once BC;

$$\therefore 11BC = 30';$$

$$\therefore BC = \frac{30'}{11} = 2\tfrac{8}{11}';$$

$\therefore$ time required $= 30' + BC = 32\tfrac{8}{11}'$ past 3.

The hour and minute-hands are also 15′ apart at 3 o'clock.

2nd. Let OE and OF represent the positions of the hour and minute-hands of the clock when they are 30′ apart.

$$\text{Then } 12BE = AF = AB + BE + EF$$
$$= 15' + BE + 30';$$

$\therefore$ as before, $11BE = 45'$, or $BE = 4\tfrac{1}{11}'$;

$\therefore$ $AF = 49\tfrac{1}{11}'$ past 3 o'clock.

5. (1) Cost of land $= \left(\dfrac{11960 \cdot 3326 \times 9}{2}\right)s. = 53821 \cdot 4967s.$;

$\therefore$ 1 hectare of land must sell for $(53821 \cdot 4967 + 3005)s.$,
or $56826 \cdot 4967s.$;

$\therefore$ 1 yd. .... $\dfrac{56826 \cdot 4967}{11960 \cdot 3326}s.$
$= 4s.\ 9d.$ nearly.

(2) 7 litres of dearer cost $4fr.\ 50c. \times 7 = 3150c.$,
5 .... cheaper .... $2fr.\ 35c. \times 5 = 1175c.$;

$\therefore$ 12 litres of spirit cost $4325c.$,
$\frac{1}{4}$ of $4325c. = 1081 \cdot 25c.$;

$\therefore$ 12 litres of spirit must sell for $5406 \cdot 25c.$,
or $12 \times 1 \cdot 76077$ pts. ....;

$\therefore$ 1 pt. must sell for $\dfrac{5406 \cdot 25}{12 \times 1 \cdot 76077}c.$, or $2fr.\ 55c.$ nearly.

(3) £117. 10*s.* ÷ 2 = £58. 15*s.* = 235 crowns,
£28. 10*s.* = £$28\frac{1}{2}$ = 57 half-sovs.,
remainder = £117. 10*s.* − £87. 5*s.* = £30. 5*s.*;
£30. 5*s.* ÷ 5 = £6. 1*s.* = 121 shillings,
remainder = £30. 5*s.* − £6. 1*s.* = £24. 4*s.*;
£24. 4*s.* = 484*s.* × 3, or 1452 four-pennies.

6. (1) 5·136 dwts. of standard gold = £1;

$$\therefore 1\text{ dwt.} \ldots\ldots\ldots = £\frac{1}{5{\cdot}136};$$

$$\therefore 4\text{ oz.} \ldots\ldots\ldots = £\frac{4\times 20}{5{\cdot}136}$$

$$= \frac{4\times 20\times 20}{5{\cdot}136}\,s.$$

$$= \text{in weight } \frac{4\times 20\times 20}{5{\cdot}136\times 66}\text{ lbs. Troy}$$

$$= 4\text{ lbs. } 8\text{ oz. } 12\text{ dwts. } 19\tfrac{901}{1177}\text{ grs.}$$

(2) £$\frac{52}{3}$, oats 4*s.* a bus., will keep for 63 d., 13 horses,

£$\frac{52}{3}$, oats 1*s.* a bus., will keep for 1 d., (13 × 4 × 63)...

£1, ... $\frac{13\times 4\times 63\times 3}{52}$ ...

£1, ... 4*s.* 6*d*.............................. $\frac{63\times 3\times 2}{9}$ ...

£1, ... 56 d., $\frac{63\times 3\times 2}{9\times 56}$ ...

£$10\frac{2}{3}$, ... $\frac{63\times 3\times 2}{9\times 56}\times 10\frac{2}{3}$ = 8 horses.

(3) On every £200 he pays 10*s.*;
∴ insurance amounts to (10 × 35)*s.* = £17. 10*s.*

7. (1) No. of men $= 50 \times 4 + 50 \times 4 + 42 \times 4 + 42 \times 4$
$= 200 + 200 + 168 + 168 = 736$.

(2) 1st lot cost $(1{\cdot}75 \times 80)$ *fr.* $= 140$ *fr.*
2nd .... $(2{\cdot}05 \times 100)$ *fr.* $= 205$ *fr.*
3rd .... $(4{\cdot}5 \times 60)$ *fr.* $= 270$ *fr.*;
∴ 340 kilog. cost 615 *fr.*;

$$\therefore 1 \text{ oz. cost } \frac{61500}{240 \times 35{\cdot}27375} c., \text{ or rather more than } 7c.$$

(3) Coach travels 9 mi. in 1 hr.;

∴ .... 11 mi. in $\frac{11}{9}$ hr.;

∴ Train......... 23 mi. in $\frac{11}{9}$ hr.;

∴ .... (23×6) mi. in $\left(\frac{11}{9} \times 6\right)$ hrs.,

or $\frac{22}{3}$ hrs.

Coach travels 138 mi. in $\frac{138}{9}$ hrs.;

$$\therefore \text{ time saved} = \left(\frac{138}{9} - \frac{66}{9}\right) \text{hrs.} = \frac{72}{9} \text{hrs.} = 8 \text{ hrs.}$$

8. (1) Weight of three ingots of gold
$= (2{\cdot}25 + 1{\cdot}40 + 3{\cdot}07)$ kilog.
$= 6{\cdot}72$ kilog.;

Weight of three ingots of silver $= (8{\cdot}35 + 13{\cdot}002 + 26)$ kilog.
$= 47{\cdot}352$ kilog.;

$\therefore$ value of gold + value of silver

$$=\left(\frac{6{\cdot}72\times 15432{\cdot}3487}{24\times 20}\times 72+\frac{47{\cdot}352\times 15432{\cdot}3487}{24\times 20}\times 5\right)s.$$

$$=\frac{15432{\cdot}3487}{24\times 20}\times(6{\cdot}72\times 72+47{\cdot}352\times 5)s.$$

$$=\frac{15432{\cdot}3487}{24\times 20}\times\left(\frac{6{\cdot}72\times 72+47{\cdot}352\times 5}{20}\times 25\right)fr.$$

$$=\frac{15432{\cdot}3487\times 180{\cdot}15}{24\times 4}fr.$$

$$=\frac{2780137{\cdot}618305}{24\times 4}fr.$$

$$=28959fr.\ 76{\cdot}685734375c.$$

(2) C's share $+\frac{5}{6}$ C's share $+\frac{2}{3}$ of $\frac{5}{6}$ of C's share $=107fr.\ 50c.$

$$\text{or }\left(1+\frac{5}{6}+\frac{5}{9}\right)\text{ of } C\text{'s share}=107{\cdot}50fr.$$

$$\text{or }\frac{43}{18}\text{ of } C\text{'s share}=107{\cdot}50fr.;$$

$$\therefore C\text{'s share}=\left(\frac{18}{43}\text{ of }107{\cdot}5\right)fr.$$

$$=45fr.;$$

$$\therefore B\text{'s share }=\frac{5}{6}\text{ of }45fr.=37fr.\ 50c.$$

$$\text{and } A\text{'s} \ldots\ldots =\frac{2}{3}\text{ of }37fr.\ 50c.=25fr.$$

9. (1) 4 hectol. of wine cost $(60\times 400)c.$ or $24000c.$;
selling price of wine $=(24000+3000)c.$
$=27000c.$;

No. of litres to be sold $=\frac{27000}{45}=600$;

$\therefore$ he must add $(600-250)$ or 350 litres of water.

(2) 20 men + 64 women + 96 children = £960. 4*s*. 4*d*.

Now 64 women = 32 men,

96 children = 32 women = 16 men;

∴ 20 men + 32 men + 16 men = £960. 4*s*. 4*d*.;

∴ 68 men = £960. 4*s*. 4*d*.;

∴ each man has $\frac{1}{68}$ of £960. 4*s*. 4*d*.

or £14. 2*s*. 5*d*.;

∴ each woman has $\frac{1}{2}$ of £14. 2*s*. 5*d*., or £7. 1*s*. 2½*d*.,

and each child has $\frac{32}{96}$ or $\frac{1}{3}$ of £7. 1*s*. 2½*d*.

or £2. 7*s*. 0¾*d*. ⅓*q*.

(3) 44 lbs. 11 oz. 11 dwts. 16 grs. Troy = 259000 grs.;

∴ No. of lbs. Avoird. = $\frac{259000}{7000}$ = 37;

No. of kilog. = $\frac{259000}{15432 \cdot 3487}$ = 16 kilog. 7 hectog. 8 décag. 2·9 gr.

CAMBRIDGE: PRINTED AT THE UNIVERSITY PRESS.